REPORT.107

PILOT WATERSHED STUDY
SOIL AND WATER ENVIRONMENTAL ENHANCEMENT PROGRAM

REPORT #1: STUDY AREA SELECTION, DESCRIPTION AND CLIMATE

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1.0 INTRODUCTION

1.1 Background

The Soil and Water Environmental Enhancement Program (SWEEP) was initiated in 1986 with an overall mandate to:

- reduce Ontario's Non-Point Source (NPS) loadings of phosphorus to Lake Erie from agricultural sources by 200 tonnes; and

- maintain or improve the productivity of the primary agricultural sector in Southwestern Ontario by reducing or correcting soil erosion and degradation.

The Pilot Watershed Study (PWS) is a major SWEEP sub-program aimed at evaluating and demonstrating the benefits of established conservation farming systems at the watershed and smaller scales. Figure 1.1 shows the overall SWEEP organizational structure and the PWS sub-program relationship to the Program. Cooperating agencies; Environment Canada (EC), Agriculture Canada (AC), and the Ontario Ministry of the Environment (MOE) are identified. Beak Consultants Limited (BEAK) is the prime contractor responsible to AC and MOE. Ecologistics Limited (ECOLOGISTICS) is a sub-contractor to BEAK responsible for site selection and the agronomic program of the PWS.

The PWS started in 1987 with detailed study design, staffing, training, cooperator enlistment, and watershed selection. Farms plans were initiated in August, 1988 and environmental monitoring began late the same year.

Monitoring and evaluation were conducted from late 1988 until mid 1992.

Figure 1.2 shows the location of PWS subject areas within the Lake Erie Watershed. These are situated within different yet common agricultural and physical settings.

The PWS has the following key features:

- four year implementation and monitoring period;
- **test** (conservation oriented systems) and **control** (conventional systems) paired watershed design;

- pro-active agronomic management involving annual farm planning, cooperator compensation program, ongoing producer extension program, availability of conservation-type farm implements, detailed cooperator record keeping, crop scouting and productivity analysis, and farm level socio-economic evaluation;
- intensive and continuous environmental monitoring at plot, field and watershed scales;
- detailed soil survey and soil quality monitoring;
- extensive environmental monitoring program including meteorology, hydrology and water quality; and
- detailed evaluation involving the application of two modelling systems for farm planning and systems evaluation.

The paired watershed study design is a unique approach which relies upon direct comparisons between the **test** and **control** areas as the primary method of environmental and agronomic evaluation. The effects of scale, at whole watershed, farm, field and plot scales are also a fundamental aspect of the study design which systematically addresses the relationship between producer attitudes and adoption as well as between measurable benefits, complexity, and scale.

1.2 Objectives of the Pilot Watershed Study

Objective Regarding Study/Approach

To achieve a high level of adoption of the most appropriate soil and water conservation practices among farm operators utilizing lands in the **test** sub-watersheds.

Strategy

1. Develop and employ a watershed selection process which:
   a) optimizes the probability of farm operator adoption of desirable practices, and
   b) can be applied effectively to critical areas in the larger Lake Erie basin.

2. Develop and utilize improved soil and water conservation planning tools for application at the farm and watershed levels.

3. Develop and utilize contract arrangements with cooperating farms operators which specify and compensate for participation in the project without "buying" their participation.

Objective Regarding Effectiveness

To determine the nature and degree of changes in relevant soil and water quality parameters and crop yields as influenced by "basin-wide" soil and water conservation practices.

Strategy

1. Select pairs of watersheds which are as similar as possible in respect to physiography, hydrology, and farming systems.

2. Develop and apply mechanisms to encourage adoption of soil and water conservation practices throughout the life of the project in the **test** sub-watersheds and to discourage adoption in the **control** sub-watersheds.

3. Establish soil, water and crop yield baseline conditions and monitor changes in relevant parameters throughout the life of the sub-program.

4. Correlate changes in soil, water and crop yield parameters to soil and water conservation practices and systems.

5. Evaluate improvements to planning tools (models) achieved during the sub-program.

6. Evaluate factors that affect the adoption of soil and water conservation practices and that influenced farmer attitudes towards both the practices and the goals of the sub-program.

Objective Regarding Information Dissemination

To prepare information about sub-program activities and results and to transmit this to participating farmers and other related SWEEP sub-programs.

Strategy

1. Collect and transmit, as required, to the SWEEP sub-program contractor responsible for the farm-level and basin-wide economic analysis.

2. Prepare information on activities and results for the communications sub-program contractor.

3. Prepare periodic reports to cooperating farmers on activities and results in written and meeting formats.

1.3 Report Structure

The overall PWS reporting has been sub-divided into the following categories:

- Study Area Selection, Description and Climate
- Implementation of Conservation Systems
- Evaluation of Conservation Systems, Social Factors
- Evaluation of Conservation Systems, Soils and Crops
- Evaluation of Conservation Systems, Hydrology
- Evaluation of Conservation Systems, Water Quality
- Modelling
- Recommendations and Conclusions
- Executive Summary

Each report is a stand alone document including a summary, descriptions of objectives, methodologies, observations, discussion, and summarized listings of relevant data where applicable. The Executive Summary is a compilation of summaries from all of the technical reports.

This report documents the study area selection process which occurred between late 1987 and mid 1988; the social, environmental and agronomic characteristics of the subject watersheds as evident during the selection process; and the weather conditions in effect during the monitoring period from the start of 1989 to mid 1992.

1.4 Specific Objectives

The components of the study documented in this report have the following objectives:

- select three pairs of agricultural watersheds in the Lake Erie drainage basin which are similar and which represent different landscapes, with commonly applied conventional farming practices, and a farming community which is open to the adoption of conservation farming systems;
- compile physical and social information on these watersheds to allow for agronomic and environmental analysis; and
- monitor meteorological parameters which affect crop performance and watershed hydrology and erosion-transport processes.

2.0 WATERSHED SELECTION PROCESS

2.1 Background

The Pilot Watershed Study was designed to be conducted in the Lake Erie watershed (see Figure 1.2) within small sub-watersheds. The sub-watersheds were to be approximately 400 ha in size and representative of broader physiographic units (Figure 2.1). Agriculture within these sub-watersheds was to be carried out on a commercial scale and typify the predominant crop and livestock systems found in Southwestern Ontario.

It was particularly important that the selected sub-watersheds be representative of the landscapes that were contributing phosphorus to Lake Erie. A classification of the study area in terms of phosphorus loading potential was developed by Miller and Spires (1978) (Figure 2.2). Major landscape units of interest in this classification were the highest class -P load > 1.4 kg ha^{-1} yr^{-1} - centred in the Essex region, and then the two most predominant classes - 0.51 to 0.80 kg P ha^{-1} yr^{-1} and 0.81 to 1.1 kg P ha^{-1} yr^{-1}. A classification of the study area in terms of erosion rates was developed by the Ontario Institute of Pedology (1984) (Figure 2.3).

Within each sub-watershed, project scope was defined with respect to three major components: physical/environmental, agronomic, and socio-economic. From a **physical/environmental** perspective, the watershed was to be treated as a complete hydrologic system. Of relevance to the study, therefore, were the crop-soil system, the runoff processes, the overland soil erosion and sediment transport mechanism, stream hydraulics and instream pollutant transport and attenuation mechanisms. In other words, the watershed was to be treated comprehensively as an integrated system.

Cropland management systems consistent with soil conservation objectives were to be of central importance in the **agronomic** component of the study. To meet the objective of achieving a comparative evaluation of paired basins at a small watershed scale, both conventional and conservation-based practices were considered on **control** and **test** watersheds respectively. Moreover, the need to implement practices comprehensively within **test** watersheds in which there were varying levels of interest required that only proven conservation practices be used. The project was therefore not intended to develop new conservation technologies.

The focus on cropland management was not to preclude an interest in livestock management. Livestock operations are a major feature in most rural landscapes and have an important influence on cropping patterns. The study areas were to include livestock operations and their associated crop rotations. However, from a water quality perspective, water related soil erosion and non-point source pollution generation, not livestock related pollution, were to be the focus of concern. Any livestock in the sub-watersheds were to be managed in a way that minimized related water quality impacts.

The **socio-economic** component was to be directly related to agronomy and, in particular, to the on-farm decision making process that related to the adoption/non-adoption of soil conservation technologies. Of interest were the range of economic, social and personal factors that bear on decision making and the influence that a deliberate farm planning process could have in affecting the farm operator's acknowledgement of soil resource problems and the decision to adopt soil conservation systems.

2.2 Approach

The purpose of this section is to provide an overview of the approach used in selecting the PWS study areas and to explain how the approach addresses project requirements and objectives. Specific details on methodology are provided for each phase of the work in subsequent sections.

The basin selection exercise was a five phase screening process that started from a geographic base comprising all rural areas of the Lake Erie drainage basin. The first phase was completed under a previous contract (CMS, 1985). In it, 10 candidate watersheds were identified within this large area (an 11th was added at a later date, see Section 2.3.2). This early analysis relied on published information and key contacts. The next four screening phases are documented in this report.

The five phases of the screening exercise are presented in Figure 2.4. This figure illustrates the progression from a general to a more detailed analysis as the focus moved from larger candidate watershed areas to specific sub-watersheds. Along the way, selection criteria and exclusionary factors were applied. Initially these were based primarily on physical attributes that were readily evaluated with published information applied at a smaller scale.

Each subsequent phase introduced a greater level of detail and expanded the range of criteria from the strictly physical in order to encompass socio-economic factors that had a bearing on the final selection. The mapping analysis was completed at a larger scale and the data inputs were drawn increasingly from primary data collection efforts. The final phase focused entirely on farm operator characteristics and relied, for these, on inputs from the local farm communities.

The virtue of this approach lay in the opportunity that it afforded to eliminate most of the unsuitable watershed and sub-watershed areas at an early stage before detailed and costly data collection efforts were started. Sub-watersheds that were carried into the final screening phases generally satisfied the more readily evaluated physical criteria and further distinctions among them could only be made based on farm operator attributes.

2.2.1 Rationale for the Screening Approach

Certain key features of the PWS had an over-riding influence on the choice of approach to basin selection. These included:

- the reliance on paired watersheds with **control** and **test** functions,
- the desire to work with existing commercial farm operations rather than in a controlled experimental setting such as a dedicated research watershed, and
- the interest in both social and technical evaluations of soil and water conservation technologies.

These factors meant that it was not enough to assure physical homogeneity across the **control** and **test** study areas as would be required under a typical experimental situation. The human dimension was of paramount importance, for without the cooperation of farm operators in each study area the PWS would not be feasible.

The need for cooperation had two important dimensions. On the one hand, it was important to have cooperators who would be willing to participate in data collection efforts. Beyond this however, cooperators would have to accommodate the technical requirements of the project in planning their field operations. In the **test** area, this required a willingness to try soil conservation farming systems that they may not otherwise have tried. In the **control** area, cooperators would have to be willing to continue with conventional farming practices despite the exposure that they would have to conservation systems.

The screening process therefore had to locate paired sub-watersheds that exhibited physical similarity, that were representative of major agricultural regions in Southwestern Ontario and that were farmed by individuals who, for the most part, were likely to cooperate with the study team. These demanding requirements necessitated an innovative methodology that enabled the screening of a very large number of candidate areas while still allowing for a degree of site specific investigation that would enable an assessment of local farm communities. The phased approach to screening fulfilled these requirements while making best use of available study resources.

2.3 Identification and Screening of Candidate Watersheds

2.3.1 Background

The starting point for selecting sub-watersheds was a set of 10 candidate watersheds identified by Conservation Management Systems in a previous study (CMS, 1985a). The selection of candidate watersheds for the Pilot Watershed Study was based on:

- potential for soil and water degradation,
- agricultural land uses,
- availability of historical water quality data and watershed studies,
- stream fisheries habitat, and
- watershed hydrologic characteristics.

The first step in the selection process involved a review and screening of the 10 candidate areas previously identified. In the screening process, the option of introducing additional candidates was retained to ensure that satisfactory sub-watersheds would emerge at the end of the search process.

This section documents results of the screening process; it presents the results of a pre-screening based on published data, a reconnaissance windshield survey, and a second, more detailed windshield survey combined with key contact interviews.

2.3.2 Pre-screening of Candidate Watersheds

The general location of the 10 candidate areas identified by the study team and an 11th identified during pre-screening are shown on Figure 2.5.

2.3.2.1 Descriptions of Candidate Watersheds

Essex Region

The Essex Region is part of the extensive clay plains covering most of Essex County and parts of Kent County. The surface is a till plain draining largely north into Lake St. Clair. The area generally has a level topography. The predominant soil type is Brookston clay. Brookston clay is a poorly drained clay and clay loam till developed from calcareous parent material. It is essentially stone free and very gently undulating. It has developed under a swamp forest of elm, black and white ash and other moisture loving trees. Large, open (municipal) drains and tile drains are commonly used throughout the area to overcome poor drainage conditions.

The basin is part of the North American corn belt. Grain corn is the most important crop. Also of importance are soybeans, hay and winter wheat. Very little livestock production occurs in this area.

Rondeau Bay Watershed

The headwaters of this watershed begin in the Blenheim-moraine which is the most prominent topographic feature in the area. It is a long east-west gravelly ridge on which the Town of Blenheim is situated. The soils are well drained gravelly loam and Miami gravelly clay loam soils. They have good infiltration rates and moderately good organic matter levels. The topography is gently undulating on the beach ridge; below the ridge to the south is a narrow band of clay soils that are topographically level, except for some deeply incised stream channels. The soils are Brookston clay loam and silty clay soils, uniform in texture and poorly drained.

Closer to the Lake Erie shoreline the topography becomes gently undulating. Surface soils found here are predominantly loams while the subsoil is generally loam or sandy loam. These Haldimand loams are imperfectly to poorly drained due to the impermeable clays found at depth. The area adjacent to Rondeau Bay is level to gently sloping. The soil surface texture ranges from sandy loam to silty clay loam. Row crops and corn systems predominate in the area, with much of the corn land used for seed corn production. There is very little livestock activity.

Newbiggen Creek Basin

The Newbiggen Creek is found within the Ekfrid clay plain in the south western part of Middlesex County. The topography is gently undulating to nearly level except where gullies have cut through the clay. Relief within the basin is minimal. The predominant soils are Brantford and Beverly clays. Brantford clay is defined as a well drained clay loam or silty clay loam while Beverly clay is defined as an imperfectly drained clay loam or silty clay loam. Both are lacustrine soils and are stone free. Because of the fine texture, slow drainage is their major limitation. This soil must be tile drained to be productive. The crops grown are mostly soybeans and corn with small grains and pasture. There is very little livestock activity in the area and only small areas of woodlot remain.

Kettle Creek Basin

This basin is located in the complex of moraines known as the Mount Elgin Ridges and on level soils below their southern flank. The topography in the moraine is complex and rolling so that a few areas have no surface drainage outlet. The two principal landforms have contrasting soils. The ridges are composed of well drained Muriel soils developed on silty clay and silty clay loam till. The lower lying landform to the south consists mainly of Bennington silt loams, imperfectly drained silt loam soils of varying depths superimposed on silty clay till material. The predominant agricultural activity is dairying with a mixed cropping system and a significant occurrence of corn.

Spittler Creek Basin

The Spittler basin is also situated in the Mount Elgin Ridges but to the east of the Kettle basin. It has physical features somewhat similar to the Kettle Creek basin. The topography is generally rolling and there are two principal landform components with contrasting soils. Soils on upland ridge areas are mapped as Huron clay loam. They are well drained and derived from clay loam to silty loam till. Low lying areas to the south of the ridge are mainly Perth clay loam, an imperfectly drained soil developed in clay loam till. A small portion of the basin is mapped as a well drained, gently sloping to rolling, stone free, Fox loamy sand. There is relatively little livestock in this area. The area is dominated by cash crop enterprises.

Beachville Area

The Beachville basin is situated in the Oxford Drumlin Field south of Woodstock. The Drumlin field is part of the Oxford till plain with well defined rolling hills. The basin contains mostly Honeywood silt loam. This soil is defined as a well drained, moderately deep, silty loam soil of lacustrine origin over loamy till. The gentle to rolling topography, good drainage, medium texture and lack of stones results in good cropland. Cash crops such as corn predominate, in addition to small grain production and dairying activity.

Holiday Creek Basin

The Holiday Creek Basin is found in the Oxford Till Plain, an area of gentle slopes, good drainage and medium textured soils. The depth of the surficial silt deposit varies throughout the area. Large areas of gently rolling land are classified as Embro silt loam or Guelph loam. Embro soil is described as imperfectly drained, moderately deep silt loam soil of lacustrine origin over loam till. It is stone free and easily tilled. Guelph loam is a well drained loamy till of mainly dolomitic origin. It is rolling in topography, medium textured and has few stones. Cash crops such as corn and small grains predominate.

Kintore Creek Basin

This basin is also situated on the Oxford Till Plain and, in part, on a Kame moraine. The soils found here are mainly Embro and Honeywood silt loams. Honeywood soil is defined as a well drained, moderately deep silt loam soil of lacustrine origin over loam till. Embro soil is part of the same soil family except that the drainage is imperfect. The topography is relatively rolling. The basin has a high proportion of its cropland in corn.

Pittock Creek Basin

The Pittock creek basin runs from north of Tavistock to Innerkip in the south. This basin is also situated in the Oxford Till Plain, with its gently rolling slopes, good drainage and medium textured soils. The major soil found in this basin is Tavistock silt loam. Tavistock soil is an imperfectly drained, moderately deep silt loam of lacustrine origin over clay loam till. It is stone free and easily tilled. Embro and Honeywood silt loams are also found in this basin. Embro is an imperfectly drained and Honeywood a well drained silt loam of lacustrine origin. They have moderate depth over loam till. These soils are also stone free and easily tilled. Finally Guelph loam soil, also found within this basin, is a well drained loam till. The north end of the basin has a mixed crop base with abundant hay crops, but corn becomes more predominant in the crop mix toward the south end of the basin.

Fish Creek Basin

The Fish Creek Basin is located on the Stratford Till Plain an area of ground moraine interrupted by several terminal moraines. The basin contains a mix of till plain, spillway and till moraine. Topography is moderately rolling to undulating, with only slightly stony soils. The main soils found in the basin are Huron and Perth clay loams. Huron soils are well drained clay and clay loam tills. Perth soils are imperfectly drained and then require artificial drainage. Huron soils, especially on rolling landscapes, are very susceptible to erosion. Two other soils found in this basin are the Listowel silt loam and the Parkhill loams. Listowel silt loam is an imperfectly drained loam till. It is gently undulating with few stones. The Parkhill loam is poorly drained loam till, level to depressional and moderately stony. Corn dominates in the crop mix of this basin.

Whirl Creek

Whirl Creek is also situated on the Stratford Till Plain. Topography is undulating to gently undulating. The two main soils here are the Perth clay loams and the Brookston clay loams. Perth soil is an imperfectly drained clay loam till and Brookston is poorly drained clay loam till. Both are relatively level with numerous low lying or depressional areas. Most of the area is used for cash crops. Considerable stream channel erosion is evident.

2.3.2.2 Selection of Candidate Sub-Watersheds

Available data on each of the eleven candidate watersheds were compiled and reviewed. These included published topographic, land use and drainage maps and aerial photography. The information was used to delineate potentially suitable sub-watersheds within each candidate watershed. The basic requirement was that each should be hydrologically discrete and measure about 400 ha in size.

Several of the candidate areas and parts of others were eliminated at this initial stage based on the published data sources and aerial photographic interpretation. Exclusionary factors included:

- presence of wetlands or significant forests,
- presence of significant point sources,
- presence of hamlets,
- presence of other significant non-agricultural uses identifiable on published maps (eg. extraction, reservoirs, lagoons), and
- irregularly shaped or especially narrow watersheds.

The excluded candidate watersheds included Beachville, Kintore Creek, Holiday Creek and Rondeau Bay.

In the Rondeau Bay Watershed and the Beachville Area topographic maps revealed a series of long, narrow basins running in parallel down the major watershed slope. These sub-watersheds included portions of so many farms that it was not possible to identify sub-watersheds that were both sufficiently large (about 400 ha) and had a small enough number of farm operators (6 to 10) to enable the project's agronomic tasks to be effectively completed. For these reasons, these candidate areas were ruled out.

The Kintore Creek Area was found to be too small to accommodate two sub-watershed areas. This constraint could conceivably be overcome by a search of adjacent areas. Such a search was not undertaken since the Kintore Creek area had been the subject of considerable non-point source remedial work including extension efforts among farm operators. This extension work could have compromised the socio-economic component of the PWS, by influencing local perceptions and soil conservation activity. The Holiday Creek area comprised a single sub-watershed and in a search of adjoining lands a suitable member of the pair was not found.

The remaining watersheds in which 55 sub-watersheds were identified included the following:

- Essex Area
- Newbiggen Creek Basin
- Kettle Creek Basin
- Spittler Creek Basin
- Pittock Reservoir Basin
- Fish Creek Basin
- Whirl Creek Basin

The locations of these candidate sub-watersheds are depicted in Maps 3.13 to 3.19 in Appendix A. Generally they were located at the upper ends of municipal drains or natural watercourses. The outlet from each sub-watershed was at or near a road; this increased the likelihood of suitable access for water quality monitoring. In addition, outlet locations were such that each sub-watershed was about 400 ha in size.

2.3.3 Screening of Candidate Sub-Watersheds

Next, a reconnaissance roadside survey was undertaken of the remaining candidate watersheds in early October 1987. The objective was to eliminate additional candidate watersheds or portions thereof, where, from roadside observations, it was either apparent that water monitoring would not be feasible or there was evidence of other sources of water pollution that could obscure pollutants originating from cropland runoff. Screening factors were:

- areas where streamflow monitoring sites at road crossings would yield sub-watersheds that were too large or too small,
- evidence of non-point source pollution problems due to animal wastes, and
- evidence of extensive stream or ditch bank erosion.

Essex Area

Within the Essex area, only the approximate areas drained by candidate drains could be determined. The lack of relief in the area made it impossible to map sub-watershed boundaries from existing topographic maps.

As expected, all sub-watershed areas in Essex were level (<1% slope) and had Brookston clay soils. Only sub-watershed 2 seemed to extend into sandy soil along the south. Row crops dominated throughout, although orchards were found on the sands in sub-watershed 2 and some hay associated with a dairy operation in sub-watershed 3, east of Blytheswood.

The drains generally appeared to be uniform with outlets that were conducive to instrumentation. Residential land use at the outlet of sub-watershed 2 could have constrained access on this drain.

Chisel plowing and windbreaks were apparent conservation practices observed in sub-watershed 1; otherwise, agricultural practices were conventional.

Potential constraints to the use of these basins included the sandy soils, livestock, residential land use, and the existing conservation practices - the first two being the most significant constraints. Additional work undertaken to define watershed divides, revealed that many drains had rather small drainage areas or were in fact interconnected with adjoining drains.

Newbiggen Creek Basin

The two sub-watersheds examined in the Newbiggen Base had very gently undulating topography with 1 to 2% slopes. Row crop and hay-based cropping systems predominated, in combination with beef and hog operations (sub-watershed 2). There were small woodlots in both areas and a number of residences in sub-watershed 2 associated with the hamlet of Uppin.

The drains appeared to be accessible and in good repair. Sub-watershed 2 had a buried drain at the top end. In this sub-watershed, one branch of the drain was found to bisect the watershed divide thus linking two discrete watersheds. A third adjacent sub-watershed to the north was also examined but was found to have a significant cattle access problem.

Kettle Creek Basin

All of the Kettle candidate sub-watersheds exhibited more relief than those above. Sub-watershed 1 to the east had long gentle slopes (2-4%), while its companion, sub-watershed 2, showed a somewhat more undulating topography with 4-6% slopes. Row crop and hay systems in combination with beef and dairy operations were found in the sub-watersheds. Sub-watershed 1 proved to be irregular and quite small (2-3 farms), while in sub-watershed 2, the drain outlet passed close enough to a house and barn such that point source contamination was considered a potential problem.

Sub-watersheds 3 to 8 occupied a landscape which had long rolling slopes (6-8%) across the north end, and a gently undulating relief (2-4% slopes) to the south. In the southwest corner of sub-watersheds 7 and 8 the topography was rolling with slopes up to 10%.

The farm systems in these sub-watersheds were like those to the east - row crops and hay or mixed systems with dairy, beef and as well some hogs. There were few fences in any of the sub-watersheds.

Buried drains were evident at the top end of sub-watersheds 3, 4 and 6. Cattle had access to the drain at the outlet of sub-watershed 5, while sub-watershed 8 had considerable buffers at the drain outlet.

In terms of size and slope, sub-watersheds 5, 7 and 8 were larger than necessary, while sub-watershed 4 was considered too long and narrow.

Other constraining factors included considerable areas of idle or marginal farm land in sub-watershed 8 and the presence of a hamlet at the top end of sub-watershed 7.

Spittler Creek Basin

Five sub-watersheds were investigated on the two designated tributaries of Spittler Creek, as well as a sixth sub-watershed adjacent to the boundary of the western tributary (not shown on map).

Sub-watersheds 1, 2 and 3 were physically similar; they originated on strongly undulating Huron clay soils (8-9% slopes) and descended to a gently sloping plain (2-3% slopes) comprised of Perth and Embro silt loams. Internally draining landscapes were evident to the north. Mixed crop systems and dairy operations predominated in these sub-watersheds.

Sub-watersheds 4, 5 and 6 were located entirely on the gently undulating plain. More corn was found here, and hog operations occurred in sub-watersheds 4 and 6.

Sub-watershed 5 had considerable idle land posted for sale, as well as larger woodlots. An unusual feature in the sub-watershed was a conservative Mennonite farm located next to the outlet. Sub-watershed 2 was found to have a pocket of forested muck soils at mid-basin and a very large poultry operation upstream. Access to its outlet was difficult; off the road at the end of a long laneway.

Pittock Reservoir Basin

Six sub-watersheds were investigated upstream of the Pittock Reservoir. Sub-watersheds 1 and 6 were found to be too small for study purposes.

Sub-watersheds two to five were all quite similar in terms of soils and slopes. Embro silt loam soils were found to have gently undulating relief while areas with Tavistock silt loam soils had long, 2 to 4% slopes which increased to 5 to 6% in the north.

Dairy operations and cash cropping were common throughout these sub-watersheds. There was an orchard in sub-watershed 3 and small areas of specialty crops (brassica) in sub-watersheds 3 and 4. Small woodlots were scattered throughout the area.

Drains were buried for much of their lengths. Open drains at the outlets appeared to be in good repair and accessible.

Fish Creek Basin

Sub-watersheds 1, 2 and 3 across the north had long rolling slopes (2-6%) while slopes were less pronounced to the south. Sub-watershed 8 was flat; relief was very gently undulating in 4 and 5, and gently rolling in sub-watersheds 6 and 7 on the east side.

Corn-grain rotations were common in all sub-watersheds and fields tended to be large with few or no fences. Dairy and beef operations were found in all sub-watersheds except 3 and 4. These operations had hay in their rotations.

In sub-watershed 4 certain operations appeared to be run down with areas of idle land, while in sub-watersheds 2, 5 and 6 cattle were found on the drain and in two cases at the outlet. Larger woodlots were found in sub-watersheds 5 and 7.

Whirl Creek Basin

Gently rolling Brookston and Perth clay soils dominated sub-watersheds 1, 3 and 7, while 2, 4, 5 and 6 had more Huron silty clay loam soils with longer slopes.

There were a few large cash crop farms in sub-watershed 1. Several of these had installed buried drains.

Corn-grain or corn-grain-hay rotations were found in the remaining sub-watersheds, all but two of which (sub-watersheds 6 and 7) had livestock including beef and dairy cattle, hogs and poultry. Drains in these watersheds were primarily open. Open drains passed through or next to barnyards in sub-watersheds 3 and 7 while cattle were pasturing on the drain in 5. Sub-watershed 5 also had a large woodlot on the north branch of the drain.

2.3.3.1 Results of Screening Candidate Sub-Watersheds

The preliminary screening analysis resulted in the elimination of four watershed areas -- Beachville, Rondeau Bay, Kintore Creek and Holiday Creek. Conclusions regarding sub-watersheds in the 7 remaining watersheds are outlined in Table 2.1.

2.4 Detailed Screening of Final Candidate Sub-watersheds

2.4.1 Background

Thirteen candidate sub-watersheds met the watershed selection criteria: they had land susceptible to erosion; soils, slopes and land uses representative of the southwestern Ontario agricultural landscape; viable conventional farms with a high proportion of land in cash crops; outlets which were suitable for hydrologic monitoring, and; a relative absence of constraints. The five candidate watersheds and the number of sub-watersheds in each were as follows:

1) Essex, in Maidstone Township, Essex County - 4
2) Kettle Creek, in Westminster Township, Middlesex County - 3
3) Spittler Creek, in North Norwich and Dereham Townships, Oxford County - 2
4) Pittock, in East Zorra-Tavistock Township, Perth County - 2
5) Whirl Creek, in Ellice Township, Perth County - 2

These watersheds were grouped according to their phosphorus loading potential (Miller and Spires, 1978). The Essex region had the highest potential, Kettle Creek and Spittler Creek were in the third highest range, and the Pittock and Whirl Creek areas were in the fourth highest range.

Table 2.2 gives the name of each sub-watershed and the numbering convention used up to this point in the report. Hereafter, sub-watersheds are identified by name or letter key. Detailed maps indicating soils, drainage, land use and farm systems for each candidate sub-watershed are contained in Appendix A.

At this stage in the analysis, three decisions were required:

1) the choice of 3 out of 5 potential locations;
2) the pairing of sub-watersheds in Kettle and Essex;
3) the choice of **test** and **control** sub-watersheds in the 3 preferred locations.

The detailed screening assessed the likelihood of success of the program in each candidate area, based on the physical data and on the results of meetings and interviews conducted with owners and operators in each watershed. The methods used to carry out this detailed screening are discussed below.

2.4.2 Detailed Screening Procedures

At this stage, information was obtained through a series of key contact interviews and a more thorough survey of watershed characteristics involving roadside and aerial photographic observations. These activities were conducted in mid November, 1987.

The key contact interviews included local agency representatives and leaders within the local agricultural community. Agency representatives included:

- township reeves or mayors,
- municipal clerks,
- drainage superintendents,
- road superintendents,
- OMAF county agricultural representatives,
- OMAF soil conservation advisors, and
- conservation authority staff.

Letters of introduction were sent to the reeves, the conservation authority chairmen and to the agricultural representatives prior to the interviews.

These contacts provided information on the general nature of the local farm community and helped clarify a number of specific issues related to:

- overland and municipal drainage,
- farmland ownership,

- local interest in soil conservation, and
- local farmer involvement with government agencies.

Roadside surveys were conducted in each sub-watershed to generally confirm or refine published information on drainage, soils, relief and land use. All roads traversing the sub-watersheds were travelled in the course of these surveys.

Crops grown in 1987 were identified and mapped on the basis of visible crop residues (corn, grain, beans) or standing crops (corn, hay). Woodlots, idle land and barnyard/residential areas were also noted. Apparent farm headquarters and non-farm residences were identified and each farm headquarters was classified by type of operation -- cash crop, specialty crop, hogs, dairy, and beef. These were determined from roadside evidence including visible livestock, type of barn and apparent crop rotation. Where livestock were present, the survey crew tried to determine if livestock had access to water courses.

Samples of undisturbed surface soils were collected at road-side locations for textural determination. As well, slopes were measured at 2 to 3 representative locations in each sub-watershed.

Preliminary verification of drainage was also conducted by roadside inspection. Open drains, natural watercourses and waterways, visible catch basins and drop inlets were mapped, and ridges dividing watersheds were identified where possible. In many cases, the township drainage or road superintendent accompanied the field staff on tours of the sub-watersheds.

Data from the field surveys were compiled on maps and in tables to facilitate a second screening of the sub-watersheds. The purpose of the screening was to narrow the number of sub-watersheds to two or three, in each candidate area. Screening was based on the following criteria:

- regularities in watershed configuration,
- undersized watersheds,
- anomalies in land use (eg. farms for sale, land slated for non-agricultural development),
- high probability of livestock related water quality problems,
- presence of marginal operations or hobby farms, and
- dissimilar soil drainage or slope conditions among potential sub-watershed pairs.

In the event that all pre-screened sub-watersheds were eliminated in a unique physiographic zone, the process was repeated starting with a preliminary delineation of potential sub-watersheds in adjacent areas.

The outcome of this stage was a set of "screened" sub-watersheds.

The farm public became involved at this point since the most critical remaining task was to identify sub-watersheds where the probability of participation by all farm operators was highest. An introductory mailing to all farmers in the pre-screened sub-watersheds was followed by public meetings in each area and personal interviews with farmers and non-farm owners of farm properties.

Mailing lists were developed from assessment rolls accessed in either township offices or regional Property Assessment Offices of the Ontario Ministry of Revenue. Personalized letters of invitation to a public meeting were mailed to all farm operators and farmland owners in the screened sub-watershed areas. One meeting was scheduled for each candidate area covering 2 to 3 sub-watersheds. At the meetings, senior project staff reviewed the goals and objectives of the Pilot Watershed Study and outlined the general nature of activities that would take place in the selected sub-watersheds. A distinction was drawn between **test** and **control** sub-watersheds and the responsibilities of the project contractor and prospective farm cooperators were discussed. Ensuing discussions during a question and answer period were recorded. These discussions provided a basis for assessing the receptivity of the local farm community to the project.

In the 3 to 4 days immediately following the first public meetings, interviews (see interview form in Appendix B) were conducted with each of the individuals identified on the mailing list. Interviews were scheduled in advance and were conducted on site (residence or farm). Every reasonable effort was made to obtain complete coverage, however, refusals were encountered in virtually every candidate area. The interview data were used to characterize farming operations, to confirm each farm's land base and to determine the likelihood of sustained cooperation. Direct questions about the respondents' interest in participation were backed up by additional questions to discern attitudes that suggested a predisposition to cooperation and to adoption of new technologies.

Following the interviews, interview forms were checked and coded. Interview data were then entered into a spreadsheet data base for analysis. Summary descriptive statistics were prepared for each sub-watershed and for all sub-watersheds in each candidate area. Interview forms were reviewed with each of the interviewers in order to obtain a better understanding of the farm operators in each sub-watershed. Data on farm headquarters, farm types and crop rotations were mapped.

Summarized and mapped sub-watershed data were then evaluated and three candidate areas were chosen. At this stage in the screening, farm operator characteristics were the primary concern. Attention was focused on:

- operator willingness to participate,
- stated farm plans over the life of the project,
- apparent stability and commercial viability of operations,
- operator experience with soil conservation,
- operator interest in being in the **test** or **control** basin,
- similarity of farm types and cropping systems across potential sub-watershed pairs, and
- number and significance of refusals in each sub-watershed.

Pairs of "preferred" sub-watersheds were identified in the three candidate areas and a preliminary designation of these to **control** and **test** functions was made.

2.4.3 Selection of Three Watershed Locations

2.4.3.1 Screening Based on Physical Properties

Table 2.3 summarizes physical characteristics of the candidate areas. While four watersheds had gentle to strong slopes, the Essex County watershed was the only candidate on the flat clay plain. This watershed's soils were characteristic of much of the land in Essex, Kent and Lambton counties, and were also recognized for their high phosphorus loads to the Great Lakes. The Brookston clay soils of the Essex County watershed represent over 40% of the Southwestern Ontario landscape. For this reason the Essex County watershed was considered an important and essential component of the Pilot Watershed Study. The Essex County watershed was therefore the first of the three watersheds to be included.

The remaining four watershed areas had somewhat similar topography and soils, with 1 to 8% slopes and silt loam to clay loam soils. Drainage patterns within the watersheds showed nothing atypical of southwestern Ontario, although the presence of organic soils and some internally drained depressions in the Spittler area were a concern.

The undulating and variable slopes in the Spittler Creek watershed, in conjunction with the drainage irregularities, were considered to be a limitation on the acceptability of the area for the project. Because one half of the pair of sub-watersheds in Spittler was more influenced by the slopes, muck soils and drainage problems than the other, it was decided that the two sub-watersheds were not adequately similar. Assigning either of the two sub-watersheds to **control** or **test** roles would limit the comparability of results drawn from them. For these reasons the Spittler Creek area was eliminated.

Soils data for the Kettle Creek area revealed that the western-most sub-watershed (A) was not similar to the other two sub-watersheds in the area. Sub-watershed A was comprised principally of Huron clay loam and silty clay loam while sub-watersheds B and C, contained more loam and silt loam soils. While this variance was a source of concern, the absence of further physical limitations in B and C suggested that the Kettle watershed could be carried forward into subsequent screening phases.

The physical data for the Pittock and Whirl Creek areas led to no conclusions regarding limitations or exclusion.

2.4.3.2 Screening Based on Public Meetings and Interviews

After the first public meeting to which all owners and operators were invited, personal interviews were arranged with operators in each of the candidate areas.

Table 2.4 shows that the interview response rate was over 80% for all watersheds, whether measured by the number of operators interviewed or by the acreage that their operations represented. The lowest level of participation was found in the Whirl Creek area, with 82% of the operators being interviewed and 81% of the acreage in the sub-watersheds accounted for.

Table 2.5 gives a general description of the farm operations in the candidate areas. Most of these data are average sub-watershed statistics for each watershed. This approach masks distinguishing sub-watershed features within individual watersheds, but allows for easy comparison between watersheds.

General statistics on the existing use of tillage and conservation practices revealed no major differences among or within watersheds. Table 2.6 shows that the moldboard plough was the principal tillage instrument in all candidate areas, and that a system involving both moldboard and chisel ploughs was increasingly prevalent. The use of rotations was least prevalent in Essex and Kettle - the areas where cash crops enterprises were concentrated - and much more common in the Spittler, Pittock and Whirl areas where livestock enterprises predominated.

Operator perceptions of soil erosion and other soil problems were the greatest in the Kettle and Essex watersheds (Table 2.7). The readiness to try conservation methods, as measured by those operators planning soil conservation measures or having contacted OMAF or the local conservation authority for assistance in regards to soil conservation, proved to be greatest in the Kettle watershed.

The farmers in Pittock showed the most interest in the project. Their overall interest level (60%) resulted from an almost 80% interest among farmers in one sub-watershed combined with a 40% interest among farmers in the other sub-watershed. Spittler farmers showed the second highest overall interest level (43%), Whirl creek followed with 34%, Kettle was 32%, and Essex farmers had an overall interest level of 25%.

The Whirl Creek watershed stood out as having the highest percentage of operators refusing to cooperate in the project. As well, Whirl Creek operators were previously shown (Table 2.4) to have the lowest level of interview participation. A cautious and somewhat antagonistic attitude towards the project was evident among Whirl Creek operators at the first information meeting. Because of the refusals and low interview participation, it was felt that the Whirl Creek watershed would not be suitable for the Pilot Watershed Study.

By this point, the three watersheds for inclusion in the project had been decided. The Whirl Creek watershed was eliminated due to operator attitudes and the low likelihood for success of the project in the area, and the Spittler Creek area was eliminated due to physical limitations. The Essex, Kettle and Pittock watersheds remained with decisions to be made as to which sub-watershed were the best candidates for the Study.

2.4.4 Selection of Sub-watershed Pairs

The Essex and Kettle watersheds both required the selection of the two best sub-watersheds. In Pittock the choice was limited to identifying which sub-watershed would be the **control** and which the **test**.

2.4.4.1 Selection of Sub-watersheds Pairs in Essex and Kettle

To facilitate the sub-watershed selection in Kettle and Essex, information on tillage, cropping practices, perceptions of soil erosion, and plans for conservation measures was assessed in conjunction with the operator attitudes toward the Pilot Watershed Study. On a sub-watershed basis, receptivity to the PWS was greatest in the Kettle Madter and East sub-watersheds, and the Essex 5th and 4th concession sub-watersheds.

In Kettle, the west drain (sub-watershed A) was found to have different soils than sub-watersheds B and C and had the fewest willing operators and the most refusals. When cropping practice information revealed that over 25% of the land in the sub-watershed was idle, in hay or permanent pasture, it was decided to eliminate the west sub-watershed. This left the Madter and East sub-watersheds as candidates.

In Essex, the North Rear Road and 2nd Concession sub-watersheds were eliminated. In the North Rear Road sub-watershed only 3 of 6 operators were interviewed. One operator with 25% of the sub-watershed acreage refused to participate, while another commented that his acreage (25% of the total sub-watershed acreage) was only a small percent of his total operation and that he was too busy to participate. Also, one operator in the sub-watershed maintained a dairy operation with a large hay acreage. In the 2nd Concession sub-watershed, two operators stated they would participate only if in the **control**, while three properties comprising almost 35% of the sub-watershed (250 acres out of 730) were either in ownership transition or soon expected to be due to the age of the owner/operator. Hence the best candidate sub-watersheds were the 5th and 4th Concession drain areas. (This selection was later reevaluated when the 4th concession drain was found to be inappropriate, see section 2.5.2.1).

2.4.4.2 Designation of Sub-watersheds as **Test** or **Control**

Sub-watersheds were designated as **test** or **control** on the basis of the first round of interviews. Impressions gained during the public meetings and subsequent interviews with operators were used to assist in the interpretation of interview data. The primary criteria used to decide which sub-watersheds would be **control** or **test** were:

- the likelihood of success of the project measured by the number and importance of refusals as well as the extent of comments showing interest in the project;
- limitations on participation such as participation being dependent on being in the **control** sub-watershed only;
- operator profiles, a combination of factors such as size and types of operations, experience and involvement in soil conservation, location of headquarters and amount and type of tenancy.

In Essex, the refusals and the limitations on participation encountered in the North Rear Road and the 2nd Concessions sub-watersheds were considered sufficient to eliminate them from the selection process, especially since the 5th and 4th Concession sub-watersheds showed much higher levels of interest with fewer restrictions on participation.

The greatest interest in the project was shown by the operators in the 5th Concession sub-watershed. Located in this sub-watershed, was a farmer who had been nominated for a County Soil Conservation Award in 1987. His farm had a large number of conservation practices and structures already in place, such as a hay rotation, buffer strips and tile outlet protection. In the 5th Concession sub-watershed 5 out of 10 operators were using a conservation tillage system - either a mixed chisel/moldboard system or a chisel system alone, and 3 operators had hay in their crop rotation. In the 4th Concession sub-watershed, only 2 of 10 operators used a conservation tillage system and no operators were using a hay rotation. Because of these facts, and because fewer concerns about project requirements were expressed by operators in the 5th Concession sub-watershed, it was selected as the **test**. The 4th Concession sub-watershed was designated as the **control**.

Section 2.5 describes in greater detail the characteristics of the sub-watersheds and points out the unique difficulties that arose in the selection of the 4th Concession sub-watershed as the **control**.

In the Kettle sub-watersheds, the Madter drain was designated as the **test** and the East drain as the **control**. The West drain, as previously noted, was eliminated.

The percentage of operators interested in the project was lower in the Madter sub-watershed than in the East sub-watershed. However, the actual number of operators interested (4) was equal in both sub-watersheds. Although one operator refused to participate in the Madter sub-watershed, his operation was already under conservation tillage, and his 8 ha (20 ac) represented less than 3% of the sub-watershed. His refusal was not expected to be a detriment to the project; in fact, he wished to be kept informed about the project, but declined to keep records.

Another factor affecting this decision was the amount of non-local farmland ownership. In the East drain 99 ha (245 ac) out of 323 ha (800 ac) (30%) were operated by non-local renters; in the Madter drain only 12% fell into this category. In the East drain, one dairy operation was reluctant to change his tillage and cropping practices on his 60 ha (150 ac).

In the Pittock area, more interest in the project was expressed by operators in the Goring sub-watershed. It was decided to use that sub-watershed as the **test**. Two operators in both sub-watersheds stated they would prefer to be in the **control** sub-watershed (they operated similar acreages 20 ha (200 ac) in each sub-watershed). When other factors were examined, such as the level of risk aversion, the desire to experiment and the level of existing on farm conservation, it was clear that the Goring sub-watershed should be the **test**.

2.4.5 Summary of Sub-Watershed Selection

In summary, analysis of available physical data led to two main conclusions: the Essex County sub-watersheds were considered essential and the Spittler Creek area should be eliminated.

The interview data, and in particular the analysis of operator attitudes and perceptions, led to three main conclusions. First, because of the high refusal rate and low receptivity to the project shown by Whirl Creek operators, this watershed was eliminated. Second, because of operator refusals, soils types, and cropping practices, the West sub-watershed in Kettle Creek was dropped. Third, because of low operator receptivity, limitations on participation and transition concerns, the North Rear Road and 2nd Concession sub-watersheds in Essex were eliminated.

Within the remaining areas preliminary sub-watershed designations as **control** or **test** areas were made as follows:

	Control	**Test**
Essex:	4th Concession Drain	5th Concession Drain
Kettle	East drain	Madter drain
Pittock	Webber drain	Goring drain

Notification of these decisions was sent to all operators in the five candidate watersheds. In the chosen areas, a second round of public meetings and interviews was undertaken to verify the selection. Section 2.5 describes in detail the sub-watersheds and the review which occurred after the second interviews.

2.5 Review of Preferred Sub-watersheds

This section details the sub-watershed review process completed after the preliminary designation of **test** and **control** areas in the Essex, Kettle and Pittock study areas. Section 2.5.1 outlines the structure and process of the second round of public meetings. Section 2.5.2 provides information about each sub-watershed based on the second round of interviews. The final selection of sub-watersheds is also discussed.

2.5.1 Second Public Meetings

After the **control** and **test** sub-watersheds were designated in Essex, Kettle and Pittock, all operators and owners in the five initial candidate areas were notified of the selections. Operators and land owners in the selected areas were invited to attend another public meeting to discuss the sub-watershed designations and other aspects of the project. Others were thanked for their interest and arrangements were made for future contacts if the selected areas proved to be unsuitable.

The second public meeting introduced and expanded upon various aspects of the Pilot Watershed Study:

- the preferred "**test**" and "**control**" sub-watersheds,
- farm conservation planning,
- agreements and responsibilities between the project and the cooperators,
- water quality monitoring,
- project equipment available to cooperators,
- record keeping requirements, and
- proposed compensation package.

Presentations were made on each topic, questions were answered and operators were encouraged to form small groups to discuss the program amongst themselves. A short plenary session then was held to field questions from each small group. (The record keeping forms, compensation package and equipment complements ultimately made available to the cooperators are described in PWS Report #3.)

Potential cooperators were then informed of upcoming steps in the PWS:

- second round of interviews - necessary to determine machinery lists, field layouts, mapping and other farm practices, and to get more input on the perception and interest of farmers in the program;
- soil survey - necessary to map, in detail, the soils of the watersheds; and
- detailed farm planning - necessary to prepare for the 1988-89 crop year.

While definitive answers could not be provided to all queries, farmers were assured they would be involved in refining the program to fit their needs.

2.5.2 Second Operator Interviews

A second round of interviews was conducted in the days immediately following the second public meeting. The purpose was to collect more detailed information on the farm operation and individual operator views about the project as proposed. Questions covered farm labour, crop management practices, the machinery complement, livestock numbers and management system, the farmland base, and field layout. More detailed information was also obtained on soil conservation measures that were in place or planned, and operator involvement in the Land Stewardship Program of the Ontario Ministry of Agriculture and Food. A sample of the questionnaire form is included in Appendix B.

Operators who had previously declined to be interviewed were approached and, if receptive, were interviewed on the basis of both the first and second interview forms.

A final evaluation of the preferred sub-watersheds was conducted after the second round of interviews. A critical concern at this stage was the level of involvement in the Land Stewardship Program and the jeopardy this might cause to our objectives for the **control** watersheds. Where potential use of soil conservation practices was deemed too high in the **control** watersheds, the screening process was reopened in order to identify an alternative sub-watershed as a **control**. The second meeting and interviews were repeated in the alternate sub-watershed.

Interviews were completed with all operators in Kettle, Pittock and Essex except for those who refused or could not be contacted. Two operators in Kettle refused the interview but expressed interest in the program. Three farm operators refused the interview in Pittock, but one remained interested in the program, while another was a tenant leasing a property for only one year. In Essex two operators could not be contacted, while another who had refused the first interview also refused the second but did express general interest in the program. Table 2.8 summarizes the response rates for the second interviews.

2.5.2.1 Re-evaluation of Sub-Watersheds

The preliminary designation of **test** and **control** sub-watersheds was reviewed using the results of the second interviews.

In addition to the primary criteria for sub-watershed selection outlined in section 2.4.4.2 more specific limitations with regard to land use and operator interest were introduced. These limitations were as follows.

Land Use Limitations

The presence of contract cropping was considered a potential detriment to the program since requirements for planting, harvesting, and other cultural practices were often specified as part of the contract.

Applications for the Land Stewardship Program were considered detrimental in a **control** sub-watershed where conventional practices were required.

Operator Interest Limitations

If operators stated that their participation was contingent on being in either the **test** or **control** areas, this influenced the allocation of sub-watersheds since a high degree of cooperation among farmers was desired. Conflicting requests by operators (eg. **control** only and **test** only requests in the same sub-watershed) were accommodated by considering the hectares each operator worked and the relative importance of the operator's land for the program.

Refusals by operators were judged according to the expected impact of the operator on the program. Refusals from operators with large acreage were considered more severe than from those with small acreage, refusals in the expected **test** watershed were considered more critical than in the **control**. Refusals by operators to complete the questionnaire(s) were considered less severe than outright refusals to cooperate provided that operators indicated approval of the program goals and tacit agreement to cooperate.

In Kettle and Pittock, the second interviews validated the **control** and **test** designations. No major constraints with regard to land use or operator interest arose. However, in Essex new information from the second interviews prompted a reconsideration of the **control** sub-watershed designation.

On the 4th Concession drain (sub-watershed 'B'), six of nine operators were intending to adopt conservation practices under the Land Stewardship Program. These farmers were also found to be highly involved in conservation practices, although in their first interviews, they stated they used fall moldboard tillage. After the second interviews, seven of these operators were found to use the chisel plough and underseeding in their rotations. Consequently, this sub-watershed was dropped as a **control**. This sub-watershed was not reconsidered as a **test** since two operators wanted $100 per acre in compensation payments if they were to be in the **test** sub-watershed, two operators expressed concern about accommodating the program with their off-farm work, and four operators were growing contract sweet corn and vegetables in the sub-watershed. For these reasons sub-watershed 'A' on the 5th Concession remained as the **test** and selection of a new **control** became necessary.

Searching for a completely new candidate area was ruled out since an exhaustive search had already been undertaken over the entire Essex area. Two previously examined sub-watersheds - the North Rear Road Drain (C) and the 2nd Concession drain (D) were therefore reconsidered.

Sub-watershed 'C' was previously eliminated because of a large dairy operation (80± cows), a larger number of non-agricultural properties including a large school (over 100 students), the refusal of one large operator and the time concerns of another. Sub-watershed 'D' was previously eliminated because of the refusal of one operator, potential refusal of another, the "**control** only" limitations of two other operators, ownership transition concerns on three properties, and the difficulty of adequately defining the sub-watershed boundary. These limitations required reassessment to allow the selection of one as a **control** area.

The presence of the dairy operation in 'C' made it dissimilar to the **test** sub-watershed, as livestock and milkhouse phosphorus loadings potentially would be present in addition to those expected from cropland. Possible non-agricultural phosphorus loadings from ex-urban housing and the school could also affect water quality measurements. These problems, in conjunction with the disinterest of two large operators in the sub-watershed, were sufficient reason to warrant exclusion of sub-watershed 'C' from consideration as the **control**. The preference for the **control** sub-watershed then fell to sub-watershed 'D'.

Factors in sub-watershed 'D' which had originally appeared detrimental were re-evaluated. Problems related to operators who stated that their participation was dependant on being in the '**control**' sub-watershed were resolved; concerns about the transition of properties (due to sale or age of operator), and the refusal of one operator were relatively less significant than problems in 'C'. The restrictions on sub-watershed 'D' were considered less severe than originally thought, and hence it was selected as the **control** area.

Letters explaining the change of **control** sub-watershed designation were sent to operators in 'B' and 'D' sub-watersheds and the second interview was completed with the farmers in 'D'.

2.5.3 Final Watershed Selection

By the end of April, 1988 the watershed and the sub-watershed designations had been finalized. The final selections were:

WATERSHED	TEST	CONTROL
Essex	5th Concession drain	2nd Concession drain
Kettle Creek	Madter drain	Holtby drain
Pittock	Webber drain	Goring drain

During the course of the selection process, sub-watershed boundaries were verified through field surveys and air photo interpretation, and additional information about farm operations and the hydrologic response of the watersheds was prepared. Section 3 presents detailed description of the final selected sub-watersheds.

3.0 STUDY AREA CHARACTERISTICS

3.1 Purpose

This chapter provides more detailed information on the sub-watersheds chosen for the PWS. The physical, land-use, hydrologic and other attributes of each sub-watershed are compared to provide a basis for determining whether or not the sub-watersheds comprised valid pairs for comparative analysis concerning erosion processes. Project implications of sub-watershed differences and similarities are discussed.

Farm specific data such as acreage, number of farms and enterprise types were compiled from interview information provided by the farmers at the beginning of the PWS. Therefore, minor discrepancies may appear between these data and "measured" or updated data used elsewhere in the PWS reports.

A detailed soil survey of the project watersheds was undertaken following finalization of the project sub-watersheds. The results of this soil survey are documented in a report by Ecological Services for Planning (ESP, 1990). Sub-watershed features are summarized in Table 3.1. Detailed descriptions follow.

3.2 Essex

The Essex watershed is part of an extensive clay plain which covers most of Essex and Kent Counties in Southwestern Ontario. Brookston clay, a poorly drained stone-free clay and clay loam till, dominate the area. A detailed soils map, illustrating soil types, slopes, and drainage classes for the Essex watershed pairs is available in the Soil Survey of the Pilot Watersheds (ESP, 1990). The topography is very gently undulating (less than 1% slope) with a gradual fall to the northeast. Surface drainage is aided by field scrape ditches, road side ditches and large open municipal drains. Subsurface drainage by systemized tillage is commonly used to assist drainage in these heavy soils. The entire region drains in a northerly direction to the Puce (**test**) and Belle (**control**) Rivers and thus to Lake St. Clair.

The Essex **test** watershed is 435 ha in size, the **control** watershed, 281 ha (Figure 3.1). Apart from being larger, the **test** watershed is somewhat more elongated in the direction of the main drainage channel than the **control**. Both watersheds are almost completely tile drained. A main municipal open drain extends from the southern limit of the sub-watershed at Essex County Road #8 to the northern limit at South Middle Road and bisects the **test** sub-watershed into two equal portions on the east and west sides. The drain runs alongside Maidstone Township Fifth Concession. Both sub-watersheds are aligned in a similar direction.

The **control** sub-watershed is located further to the east (Figure 3.1) and drains in a northerly direction from Essex County Road #8 to the CP railroad line. The sub-watershed is also approximately rectangular in shape. A main open municipal drain runs alongside Maidstone Township Second Concession Road dividing the sub-watershed in two parts with the largest portion to the west of the drain.

These sub-watersheds lie within an area that is well known for high soil loadings (>600 kg/ha/yr) and phosphorus runoff (>1.4 kg/ha/yr) (PLUARG, 1978). This situation is a result of a combination of factors including poorly draining soils with low soil infiltration, which lead to high surface water runoff rates and extreme storm events, and heavy clay soils which tend to remain in suspension in runoff water resulting in a high delivery ratios.

Given the size and shape differences, the two watersheds were expected to have a somewhat different response to rainfall. Watershed runoff was estimated with the Hydrologic Computer Model (HYMO) which used the United States Soil Conservation Service method. This analysis revealed that the simulated hypothetical time to peak flow from rainfall events was almost identical in both watersheds. The simulated runoff hydrographs for the sub-watershed outlets are shown in Figure 3.2. The differences in the peak flow and recession curves seen here recurred over a range of simulated rainfall conditions. Higher peak flows in the **test** sub-watershed are attributed to the fact that the **control** watershed is smaller and shorter than the **test** watershed. These differences are small and the hydrologic response of the two watersheds does not therefore appear to be significantly different.

There were 14 farms in the **test** watershed and 12 in the **control**. Farm size ranges from a low of 12 ha (30 acres) to a high of 567 ha (1400 acres). Figure 3.3 shows the size distribution of farms in both watersheds and the area of land that each farmer had in the watershed. Four farmers were operating completely within the **test** area and 3 within the **control**.

By the end of the basin selection process only one farmer in the **control** area had declined to participate, but he had expressed some interest in learning more about the program. The overall level of interest in the program was high in both watersheds. The percentage of the farm operation within the study area therefore did not appear to have appreciable effects on operator interest.

All enterprises in the Essex study areas were cash crop operations, with the exception of one farmer who grew hay in the **control** watershed to support a dairy operation (Figure 3.4). The main crop rotation was a grain corn - soybean rotation. Primary tillage was usually done with a moldboard plough, although some operators were using a chisel plough as well (1 in the **control**, 6 in the **test**). Fertilization and pesticide practices were conventional and no unique pest problems were noted by farmers in these areas.

The Essex study area included a number of part time farmers and farmers with off farm work. This is not unusual for farms in the Essex county area.

Soil problems were noted by 21% of the **test** farmers and 33% of the **control** farmers, while 43% and 25% respectively stated they had used or were planning to use soil conservation methods such as cover crops, spring tillage, chisel ploughing and grassed waterways.

Runoff and water quality monitoring were conducted on the main drains at the mouths of these sub-watersheds as shown in Figure 3.1. The open municipal drains at the monitoring sites are wide trapezoidal channels with steep sides excavated to 1 to 1.5 metres below road grade. The **test** and **control** sites were monitored for almost four years (1988 to 1992) as part of this study.

3.3 Kettle Creek

The Kettle Creek Watershed is located in Middlesex County within the Town (formerly Township) of Westminster. This area is characterized by complex, rolling landscape (6-8% slopes) on the northern portion in the area known as the Mount Elgin Ridges, and by some gently rolling landscapes (2-4% slopes) in the southern portions. The soils of the Mount Elgin Ridges are well drained Muriel soils on silty clay and silty clay loam till. The soils of the southern portion are typically imperfectly drained Bennington silt loams atop silty clay till material. Soil types, slopes, and drainage classes for this area are illustrated in detail in the Soil Survey of the Pilot Watersheds (ESP, 1990).

The stronger relief and higher silt content of soils in Kettle Creek increases the erosivity of its landscape relative to other study basins. Slopes are as high as 10% in some areas. Eroded soil profiles are pronounced throughout this basin.

Both the Kettle Creek sub-watersheds are drained in a southerly direction by open municipal drains to Kettle Creek which drains southerly to Lake Erie. Surface flows run across open fields and grassed waterways to the open drains. During the selection process it was found that random tile drainage was the predominant method of field drainage because of the topography and soils of the watersheds. Over 80% of each watershed was randomly drained. Only 8 acres were systematically drained in the **test** watershed, and 40 acres in the **control**.

Figure 3.5 identifies the Kettle Creek sub-watersheds. The **test** sub-watershed is located to the west, drained by the Madter Drain. This sub-watershed is about 410 hectares in size, with headwaters located at the Lake Huron-Lake St. Clair divide just north of the Fifth Concession Road near the Hamlet of Hubrey, and extending south 3 kilometres to the Seventh Concession Road. Both sub-watersheds are aligned in a similar direction.

The **control** sub-watershed is about 350 hectares in size, with headwaters beginning on the south side of the Fifth Concession Road near Victoria Road and extending about 2.6 kilometres south to the Seventh Concession Road. The **control** sub-watershed is drained by the Holtby Drain which passes through a small forested wetland near the mouth on the north side of the Seventh Concession.

The peak flow from a 10 year return storm on the **test** sub-watershed was estimated to be 1.75 times higher than on the **control** sub-watershed (Figure 3.6). This difference occurred because of the greater proportion of poorly drained soils in the **test** sub-watershed. Times to peak flow were estimated to be almost identical in the two sub-watersheds.

These watersheds lie within an area designated as having moderately high potential for soil loadings (350 to 475 kg/ha/yr) and phosphorus runoff (0.81 to 1.10 kg/ha/yr) (PLUARG, 1978). This situation is primarily due to fine soil particle sizes (susceptible to erosion), slopes of up to 12%, and relatively poor draining soils with low infiltration rates which result in high water surface runoff.

There were 14 farms in the **test** sub-watershed and 10 in the **control**. Two farm operations had land in both sub-watersheds. One of these farms was headquartered in the **control**, the other in the **test**, and both farmers operated similar acreages in the non-headquarter watershed. Farm size ranged from a high of 1619 ha to a low of 20 ha (see Figure 3.7).

Three farmers had farms that were completely within the **test** area, but no farms were completely within the **control**. Figure 3.7 shows the size distribution of farms and the proportions of each within the watershed.

While cash cropping predominated, livestock operations were found in both sub-watersheds (see Figure 3.8). The principal crops grown in Kettle Creek sub-watersheds were corn, soybeans, wheat and hay. Hay rotations were found primarily in the **control** watershed. Contract sweet corn and some vegetables were grown in both sub-watersheds. The willingness to apply conservation practices on the **test** sub-watershed did not appear to be compromised by the amount of contract cropping. The moldboard plough was the main primary tillage tool, although the chisel plough was also used by many operators in the **control** (40%) and the **test** (50%) watersheds. Two secondary tillage passes were the norm, and conventional fertilizer and pesticide practices were used.

Two farmers with less than half their operations in the **test** declined to participate actively in the Study, but they wished to be kept informed. This suggested that at some stage they may have wanted to participate.

The percentage of each farmer's operation within a sub-watershed did appear to have some influence on receptivity to the project at the outset of the Pilot Watershed Study, but the impact of non-participation did not appear significant at the basin selection stage.

Soil problems were noted by 43% of the **test** farmers and 40% of the **control** farmers. The proportion of farmers planning to try soil conservation methods (before being introduced to the PWS) was 43 and 70% in the **test** and **control** sub-watersheds respectively. The apparent interest in soil conservation in both areas was seen to potentially pose a problem over the course of the study if too many **control** hectares were converted.

Water quality and flow were subsequently monitored at the Seventh Concession bridges crossing the Madter and Holtby Drains throughout the study. The Madter and Holtby Drains are open irregular wide trapezoidal channels at the monitoring sites.

3.4 Pittock

The Pittock watershed lies within the headwaters of the Thames River upstream of the Gordon Pittock Reservoir in East Zorra Township, Oxford County. The sub-watersheds overlie the Oxford Till Plain with gently rolling landscapes (2-4% slopes) and good drainage through medium textured silt loam soils. The predominant soil is the Tavistock silt loam, a stone-free imperfectly drained, lacustrine deposit over clay loam till. Embro and Honeywood silt loams and Guelph loam are also common. Pittock area soils, slope classes and drainage classes are illustrated in detail in the Soil Survey of the Pilot Watersheds (ESP, 1990).

Figure 3.9 shows the location and shape of the Pittock **test** and **control** sub-watersheds. The **test** sub-watershed is further north extending from 2 concession roads west of Provincial Highway #59 to one concession road east of the highway, a distance of about 4.0 kilometres. This sub-watershed has a maximum width of about 1.6 kilometres and a total area of 359 hectares. The **control** sub-watershed is more compact extending about two concessions to its outlet at Highway #59. The **control** sub-watershed is 384 hectares in area. Both sub-watersheds are aligned in a similar direction.

The **test** sub-watershed (Goring drain) is drained by a covered municipal drain in the top two thirds of the watershed and an open municipal drain in the bottom third. The **control** sub-watershed (Webber drain) is drained almost entirely by a covered municipal drain. Systematic tile drainage was found on 90% of the **test**, while the **control** had 50% systematic drainage and 30% random drainage.

These watersheds lie within an area designated as having medium potential for soil loadings (225 to 350 kg/ha/yr) and phosphorus runoff (0.51 to 0.80 kg/ha/yr) (PLUARG, 1978). Erosion and runoff here are aggravated by soils with low infiltration, poor drainage and moderate susceptibility to erosion.

Hydrologic modelling of the sub-watersheds shows that both have similar peak flows for the range of storm durations and rainfall return periods that were evaluated. This similarity is shown for a 10 year return storm event in Figure 3.10.

There were 14 farms in the **test** sub-watershed and 15 in the **control**. In the **control** there were two farmers who refused to participate in the project. In the **test** there was one farmer who was willing to participate but was unwilling to keep records.

Figure 3.11 shows the size distribution of farms in the watersheds and the proportion of land within the sub-watersheds. Farm size ranged from a low of 12 ha (30 ac) to a high of 688 ha (1700 ac). One farmer operated land in both sub-watersheds, but the majority of his land was in the **test**.

Four farmers operated completely within the **test** area, and 6 had more than half their operation in the sub-watershed. In the **control**, 2 farmers worked all their land within the sub-watershed, and 4 had more than half their operation in the **control** study area. The majority of Pittock farms were livestock operations (Figure 3.12). The main crop rotation was a corn-bean-grain-hay combination on the livestock farms, while a corn-bean-grain combination was common with cash crop operations.

A 20 hectare seed corn breeding and research station was located near the centre of the **test** sub-watershed, almost on the drain. Eight hectares of this land was used for small plot trials, while the remainder was farmed conventionally.

The primary tillage instrument was the moldboard plough. The chisel plough was used by 3 **test** operators but no **control** operators. Fertilization and pesticide practices in the watershed were conventional, although a few farmers used a rotary hoe rather than herbicides for weed **control**.

Cultural practices on the limited contract crops found in the area did not differ significantly from crops grown for conventional harvest. No problems were identified in accommodating the current levels of contract cropping in the sub-watersheds.

Three farmers in both sub-watersheds noted soil problems on their farms, while 57% had or were planning to try soil conservation methods in the **test** and 27% in the **control**.

3.5 Microbasins

Through 1989 microbasins were selected within the sub-watersheds. Two microbasins were selected and instrumented in each sub-watershed; twelve were selected in all. These areas represent the field scale and provided for field scale assessments of runoff and loadings. Table 3.2 lists microbasin characteristics.

Microbasins were selected so that surface runoff could be monitored for flow rates and quality during events at good hydraulic **control** sites. Outlets of microbasins generally were located in shallow ditches, at road culverts, or at drop inlet structures. These sites generate no subsurface runoff. Microbasins were also selected so that landscapes, farming practice, soils and slopes were typical of the greater sub-watershed. Microbasins did not contain substantial amounts of untilled land.

Figures 3.13 to 3.15 show the location and shape of microbasins in the six sub-watersheds.

3.6 Summary

The three selected Pilot Watershed Study areas represented typical farming communities in Southwestern Ontario. Cash cropping and livestock operations predominated. Interest in the Study was high in all the areas, with only two out of 78 farmers declining to participate in any way. Similar numbers of farmers operated in each area and the majority of farms were larger commercial operations. Cultural practices were conventional, though experimentation with conservation practices had occurred in all the sub-watersheds.

From a socio-economic perspective, the three pairs of sub-watersheds fulfilled project requirements in that they contained commercial farm operators who were familiar with conservation issues, but were generally committed to conventional farming methods at the time of the selection. This enabled a more critical examination of a pro-active approach to encourage the use of soil conservation practices.

From a physical standpoint, the sub-watersheds are considered to be as closely paired as could be expected given the various constraints and objectives that were in effect during the selection process. Differences among sub-watershed pairs in shape, size and soils caused somewhat dissimilar hydrologic responses. These differences necessitated a more critical approach in the analysis of monitoring data and encouraged greater reliance on field scale investigations and modelling analysis to help interpret monitoring results from the watershed outlets.

4.0 CLIMATE

Meteorological parameters have a significant impact on a number of key elements of the SWEEP Pilot Watershed Study (PWS). For instance, precipitation, which results in surface runoff and percolation through the soil column to the sub-surface drains and the groundwater table, is the primary driving force behind soil and agri-chemical migration. Other meteorological variables, such as temperature and relative humidity, affect rates of evaporation, snowmelt, soil temperature and infiltration rates, biochemical degradation rates, volatilization of soil gases, and crop development. These are all important natural processes which affect the state of water, soil and chemical components in the three study watersheds. Accordingly, meteorological monitoring stations were maintained in each of the paired watersheds as part of the PWS.

4.1 Installations

Figures 4.1 to 4.3 indicate the location of meteorological stations and rain gauges within the PWS sub-watersheds. Instrumentation was installed late in 1988 to early 1989 following selection of the sub-watersheds, construction of watershed outlet shelters, and establishment of site offices.

The PWS primary weather stations, located at the site office in each watershed continually monitored the following meteorological parameters (sampling frequencies noted in brackets) throughout the four years of this study:

- rate of rain or snow (every 15 minutes);
- windspeed and wind direction (every 5 minutes);
- air temperature (every 15 minutes); and
- solar radiation (every 15 minutes).

Essentially, each of the primary weather stations were identical with a few exceptions. The Essex and Kettle Creek stations both used Handar data loggers whereas the Pittock station used a Memodyne data logger with a fixed sampling frequency of 15 minutes for all the measured variables. The sampling frequency for air temperature at Kettle Creek was 60 minutes and 10 minutes for both the rate of precipitation and solar radiation.

In addition to the automated monitoring, potential evaporation (May to November only) and rainfall from standard rain gauges (March to December) were manually recorded by the watershed technicians on a routine basis.

The **secondary weather stations** were located at the outlets of the **test** sub-watersheds, and were housed within the Water Survey of Canada streamflow gauge shelters. These stations were the responsibility of the Ontario Ministry of the Environment and augmented the main station systems. The individual secondary weather stations were entirely identical in terms of instruments used and data collected. Each station used a Campbell Scientific datalogger model 21X, with a modem connection to BEAK's Guelph office so that field staff would be mobilized for runoff water quality sampling.

The meteorological variables measured and recorded at these stations included hourly rate of rainfall, average hourly air temperature, average hourly water temperature and soil temperatures at three depths (5, 50 and 150 cm depths). The Kettle Creek station also had a relative humidity sensor. The tipping-bucket raingauges at these sites were not heated, so rate of rainfall data were available only for the April 1 to November 30 period. Further information about the secondary weather stations has been presented by BEAK (1989).

In addition to the instrumented weather stations, additional standard precipitation gauges were sited in various locations within the pilot watersheds (Figures 4.1 to 4.3) to assess the spatial distribution of precipitation amounts. Table 4.1 summarizes the instrumentation and recording intervals at the primary and recording weather stations.

The automated systems functioned satisfactorily for the duration of the study with some periods of lost data due to occasional power outages or instrument failure. For these periods, data from nearby regional weather stations were substituted. Table 4.2 provides a list of the available meteorological data used to augment the data base or to provide a comparison of collected data for quality control purposes. The information presented here is the best record based upon available site specific information or fill-in source data.

The following sections summarize the meteorological data recorded over the period of study. The longterm normal values used for comparison with the data collected during the Pilot Watershed Study are from the AES stations closest to the watershed. Daily formats and graphical summaries of the collected data are presented in Appendix C.

4.2 Temperature Data Summary

4.2.1 Air Temperatures

Daily Average Air Temperature

Daily average temperatures are presented in Appendix C.

Monthly Average Air Temperature

Table 4.3 summarizes the average monthly air temperatures for the period of January 1989 to June 1992. Figures 4.4 to 4.6 display the monthly average values and normals in graphical form. Maximum, average and minimum daily temperatures in the study watersheds are provided in tabular form in Appendix C.

For the purpose of comparison with longterm normal temperatures, the longterm normal values (1951 to 1980) for the closest AES stations are also presented in Table 4.3. Essex watershed monthly averages are compared to Agriculture Canada's Woodslee Station normal values; Kettle Creek watershed monthly averages are compared to Westminster W.P.C.P. normal values; and Pittock watershed data are compared to Woodstock W.P.C.P. normal values. Provisional longterm normals incorporating more recent data (up to 1990) were available for selected parameters but are not referenced since they do not differ significantly from the 1951 to 1981 normal values and also vary in the time period represented for the three AES stations of concern.

In comparison to the normal annual average temperature, all three watersheds in question experienced a cooler than normal year in 1989 and warmer than normal years in 1990 and 1991. The first six months of 1992 were close to the normal temperatures for that portion of the year. Winters were considerably warmer than normal from 1990 to 1992. In 1989, January was considerably warmer and December considerably colder than the respective longterm normals in all three watersheds. For the balance of the year, including the growing season, average temperatures did not deviate significantly from the longterm normal temperatures.

In 1990, the months of January, February, March and December all exhibited warmer than normal air temperatures in all watersheds. As in 1989, the balance of the year, including the growing season, did not vary greatly in temperature from the longterm normals.

In 1991, February, March, May, June, and December all experienced higher than normal temperatures in all three watersheds. In the Kettle Creek and Pittock watersheds, April was also warmer than normal and the month of November was colder than normal in the Kettle Creek watershed.

In 1992, January and February were again warmer than normal in all watersheds except for the month of January in the Pittock watershed, which was close to normal temperature. The months of March, April and June were cooler than normal in the three watersheds.

Extreme Air Temperatures

Maximum and minimum air temperatures (from hourly recordings) for the three watersheds for the period of January 1989 to June 1992 are presented in Tables 4.4 and 4.5 respectively.

The single extreme air temperatures (both maximum and minimum) are presented in Table 4.6. The lowest recorded air temperature (from hourly recordings) since the onset of monitoring are -23.7 ° C in Essex (December 22, 1989), -20.7 ° C in Kettle Creek (December 22, 1989), and -23.7 ° C in Pittock (February 12, 1992).

The highest recorded air temperatures since the onset of monitoring are 35.3 ° C in Essex, 34.9 °C in Kettle Creek, and 34.0 ° C in Pittock (all on July 4, 1990).

4.2.2 Corn Heat Units

Corn Heat Units (CHU) are based on the relationship between ambient temperatures and the rate of corn maturation, since the rate of plant development varies with temperature. The system of CHU calculation involves daily average, maximum, and minimum air temperatures taken over the growing season. The growing season is considered to start on the date on which a longterm mean temperature of 12.8 C° or higher is first reached in the spring and finishes on the date before which a killing frost can be expected one year in 10 (Brown, 1978). The approximate corresponding growing seasons are May 10 to September 30 in the Essex watershed, May 16 to Sept 20 in the Kettle Creek watershed, and May 18 to September 16 in the Pittock watershed.

The corn heat units produced during the three full growing seasons encompassed by the SWEEP PWS study are presented in Table 4.7 along with the normal CHU totals for the three watersheds. On average and throughout the period of study the Essex watershed had the highest CHU values, exceeding the CHU totals of the Kettle Creek and Pittock watersheds by an average of 16.5 % and 24.3 %, respectively, over the three growing seasons. In 1989 and 1990, all three watersheds had CHU values significantly lower than their respective normal values. In 1989, CHU values were 7.4 % below normal in Essex, 4.3 % lower than normal in Kettle Creek, and 3.8 % lower than normal in Pittock. In 1990, CHU values fell short of normal by 7.9 % in Essex, 9.0 % in Kettle Creek, and 8.7 % in Pittock. In 1991, CHU totals were very close to normal, only slightly exceeding the respective normals in all three watersheds.

4.2.3 Soil Temperature

Figures representing daily and monthly average soil temperatures at three depths (5 cm, 50 cm and 150 cm) in each watershed are presented in Appendix C.

Monthly average soil temperatures at three depths and corresponding monthly average air temperatures are presented in Tables 4.8 to 4.11. Graphical representations of the above data, along with graphic representations of daily soil temperatures at three depths, are included in Appendix C.

The surface (5 cm) soil temperatures tend to track within 2 celsius degrees of the daily average air temperature in ice free periods and slightly more moderate during winter periods. The deeper soil temperatures display much more moderate temperatures with far less daily variation. The deeper soil temperatures ranged by about 18C° (50 cm) and 15C° (150 cm) on an annual basis. Freezing was not observed at the 150 cm depth and only briefly at the 50 cm depth.

4.3 Precipitation Summary

Daily Precipitation

Summaries of daily precipitation for January 1989 through to June 1992 are presented in Appendix C.

Monthly Total Precipitation

Table 4.12 summarizes the monthly precipitation totals for all three watersheds for the years 1989 to 1992. Figures 4.7 to 4.9 display monthly total precipitation and normals in graphical form. Longterm normals are also provided for comparisons in Table 4.11. Precipitation totals for Essex are compared to Agriculture Canada's Woodslee Station (1946 to 1988); Kettle Creek is compared to Westminster W.P.C.P. (1961 to 1990); and Pittock is compared to Woodstock W.P.C.P. (1951 to 1980). Longterm normals incorporating data for the most recent decade were available for comparison with the Pittock watershed but these normals also incorporate data dating back to 1870 and are therefore inconsistent with normal data used in comparison with the other two watersheds.

In 1990, all watersheds received more precipitation than their respective longterm normal annual totals by 16% in Essex, 23% in Kettle Creek and 8% in Pittock. The years 1989, 1991 and the first half of 1992 were much drier than normal in all watersheds. Over the 42 month period 1989 to 1992, total precipitation fell short of long term normals by 11% in Essex, 18% in Kettle Creek and 22% in Pittock.

In 1989, January through March and the months of August and December received less precipitation than the longterm normal monthly totals in all three watersheds. The months of April and September were also drier than normal in the Kettle Creek and Pittock watersheds. October was drier than normal in the Essex and Pittock watersheds and July was also drier than normal in only the Pittock watershed. In all watersheds, the month of May was much wetter than normal as was June in the Essex watershed and November in the Pittock watershed.

The year 1990 was wetter than average in all watersheds, especially during the growing season. January, March and April were much drier than normal in the three watersheds. June was drier than normal in only the Pittock watershed. The months of May through to October (except June) as well as February were wetter than normal in all watersheds.

In 1991, each watershed received less than normal precipitation. January, February, June, September and December were extremely dry in all watersheds compared to the respective longterm normals. July was also drier than normal in the Essex and Kettle Creek watersheds. August rainfall was below normal in the Kettle Creek and Pittock watersheds. The only months experiencing greater than normal precipitation were May (Essex only), June (Pittock only) and October (Essex and Kettle Creek).

All months through to June in 1992 were drier than the longterm normals except February in Essex and Kettle (normal total precipitation) and April (wetter than normal in all watersheds). Figure 4.10 displays the distribution analysis for precipitation for the fall monitoring period for each watershed. The records from the three areas are in close agreement.

Overall, winter periods (December through March) received far less precipitation at 48% (Essex), 56% (Kettle Creek) and 43% (Pittock) of the long term normals over the study period. Non-winter periods actually received near normal precipitation totals in Essex, 85% of normal in Kettle Creek and 13% more than normal in Pittock, on average.

Total Cumulative Precipitation

The cumulative precipitation for the period of January 1989 to June 1992 at standard rain gauges, as well as automated gauges, is graphically represented in Appendix C. The graphs illustrate variability in rainfall both within and between watersheds, as expected. Differences in recorded rainfall can be a result of localized wind turbulence or thunderstorm cells.

Extreme Precipitation

Maximum hourly and daily precipitation totals recorded over the study period are presented in Tables 4.13 and 4.14 respectively. The highest single recordings of precipitation (both hourly and daily) are presented in Table 4.6. The greatest hourly precipitation totals were 31.8 mm in the Essex watershed (1700 hrs., June 19, 1989), 66.5 mm in the Kettle Creek watershed (1600 hrs., August 28, 1990), and 27.3 mm in the Pittock watershed (2300 hrs., July 8, 1990). The greatest daily precipitation totals were 65.7 mm in the Essex watershed (September 6, 1990), 95.6 mm in the Kettle Creek watershed (August 28, 1990), and 63.3 mm in the Pittock watershed (July 08, 1990).

Figures 4.10 and 4.11 show the frequency distribution of daily and 15 minute total precipitation for all three watersheds. All watersheds display a similar distribution of events. They also commonly display a relative lack of extreme events. Aside from the extreme events noted in Table 4.6 and above, there were very few significant storms either in terms of total rainfall or short term intensity. Table 4.15 summarizes the number of significant events in three total event precipitation volume categories. During the entire study only 3 events exceeding 6 cm in one day were experienced with one in each area in 1990. Events in the range of 4.0 to 6.0 cm/day were also rare at nine for the whole area and time period. The more extreme events generally occurred in spring and fall with the exception of the most extreme events in each area which occurred in July to September, 1990 (see Table 4.6).

4.4 Potential Evaporation

Potential evaporation was monitored in the three watersheds using 120 cm diameter pans located on the roof of each site office. Evaporation was estimated by adding water every few days to maintain the level of water constant in the pan. Corrections were made for precipitation. Pans were monitored during frost free periods only. The recorded evaporation rates for the period of January 1989 to June 1992 are presented in Table 4.16.

Essex watershed had the highest evaporation rates on average and evaporation was highest in 1991 in all three watersheds. Actual evapotranspiration is somewhat less than potential evapotranspiration and is a function of vegetative cover and moisture availability.

4.5 Windspeed

Daily Average Windspeed

Daily average windspeeds (m/s) for the period of study (1989-1992) are summarized in Appendix C.

Average Monthly Windspeed

Table 4.17 contains the monthly average windspeeds (m/s) for the three watersheds over the period of January 1989 to June 1992. Normal values presented are from Windsor Airport for the Essex watershed, London Airport for the Kettle Creek watershed, and Waterloo Wellington Airport for the Pittock watershed. All normal values are based on data collected from 1951 to 1980.

Maximum Daily Windspeed

The highest daily windspeeds recorded over the monitoring period are presented in Table 4.18.

Single extreme windspeeds are presented in Table 4.6. The highest recorded windspeeds are 20.3 m/s in the Essex watershed (April 15, 1991), 17.3 m/s in the Kettle Creek watershed (January 25, 1990), and 14.8 m/s in the Pittock watershed (January 25, 1990).

4.6 Solar Radiation

Daily Solar Radiation

Graphs of daily solar radiation for all watersheds are presented in Appendix C. Due to difficulties with the Kettle Creek solar radiation monitoring equipment in 1989, London Airport AES station data are used to fill the gap for this period.

Monthly Solar Radiation

Monthly solar radiation (photosynthetically available wavelengths) data are presented in Table 4.19. The overall trend is that the Essex watershed received 10% more solar radiation than Kettle Creek and 17% more than the Pittock watershed. This is largely due to the differences in latitude and cloudiness for the three watersheds.

Higher solar radiation in 1991 on average coupled with higher air temperatures that year are positive factors for crop production. However, 1991 was also a dry year which could more than offset the benefits of temperature and sunlight in that year.

4.7 Summary

Relevant observations regarding the study period climate are summarized below.

- Winter air temperatures generally exceeded long term normals for all years in all study areas. This resulted in winter rainfall dominating rather than snowfall for most winter precipitation events. Snow cover was minimal compared to long term trends.

- Spring through fall air temperatures were generally close to long term normals on a monthly average basis in all three study areas.

- Annual average air temperatures deviated from the long term normals by less than 1C° in all study areas for the period 1989-91.

- Air temperatures in Essex are about 1.2 to 1.4C° higher than in Kettle Creek and Pittock on an annual basis respectively.

- The years of 1989 and 1991 had less than normal precipitation in all areas. The 1991 precipitation was only about two thirds of the normal rate on average across all study areas.

- The 1990 total precipitation exceeded long term normals by 8% (Pittock), 16% (Essex) and 23% (Kettle Creek).

- Winter (December - March) precipitation was mostly rainfall and was well below normal volumes (<50% of normal) in all winter seasons (1989-92) in all watersheds with a few monthly exceptions (November 1989, February 1990, November 1990 and December 1990).

- Non-winter precipitation was near normal in all areas.

- The most extensive precipitation events occurred in July to August (1990) in the three study areas during periods of time when soil moisture was low and groundwater levels were very low.

- The frequency of severe storms (>4 cm/d) were very low with only 3 (Essex), 5 (Kettle Creek) and 3 (Pittock) events recorded over the entire study period. Events exceeding 6 cm/d were very rare at one per area over the entire study period.

- Solar radiation, windspeed and relative humidity were typical in the long term and in themselves are not expected to result in any notable effect in terms of agronomic or environmental factors. These parameters did not vary widely from year to year in any area.

- Climate was not drastically different between study areas in any parameter monitored. These study areas lie within a similar macro climatic zone and thus are subject to similar weather patterns.

5.0 REFERENCES

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TABLE 2.1: SUMMARY OF SUB-WATERSHED CONSTRAINTS, PWS

Candidate Sub-watershed	Status *	Constraints
Essex Region		
1	out	sandy soils, conservation practices
2	out	residential land-use at outlet, orchard
3	out	dairy operation
4 to 12,16,17	out	too small, interconnected drains
13,14,15,18	in	-
Newbeggin Creek		
1	out	no pair once 2 was dropped
2	out	interconnected drain
Kettle Creek		
1	out	too small
2	out	point source problem
3	out	too many buried drains
4	out	too narrow
5	in	outlet moved North to reduce size and avoid cattle access
6	out	plan of sub-division at outlet
7	in	East branch only to reduce size and avoid hamlet
8	in	East branch only to reduce size and avoid idle land
Spittler		
1	in	-
2	in	-
3	out	too small
4	out	did not include Huron soils
5	out	land for sale, large woodlots
6	out	did not include Huron soils
Pittock Reservoir		
1	out	too small
2	out	too narrow
3	in	outlet moved west to reduce size
4	out	too narrow, large woodlot at outlet
5	in	outlet moved west to reduce size
6	out	too small

Candidate Sub-watershed	Status *	Constraints
Fish Creek		
1	out	too small
2,5,6	out	cattle on drain
3	out	no pair
4	out	run-down farms
7	out	large woodlot
Whirl Creek		
1	out	no pair
2	in	-
3,7	out	point source problems
4	in	-
5	out	large woodlot
6	out	too small

* in - to be further considered
out - no further consideration

TABLE 2.2: NAMING CONVENTION FOR SUB-WATERSHEDS, PWS

Watershed	Sub-Watershed Letter Key	Sub-Watershed Name	Sub-Watershed Number
Essex	A	5th Conc. Drain	15
	B	4th Conc. Drain	14
	C	North Rear Road Drain	18
	D	2nd Conc. Drain	13
Kettle	A	West Drain	8
	B	Madter Drain	7
	C	East Drain	5
Spittler	A	Fewster Drain	1
	B	Newark Drain	2
Pittock	A	Webber Drain	3
	B	Goring Drain	5
Whirl	A	Smith Drain	4
	B	Foley Drain	2

TABLE 2.3: PHYSICAL CHARACTERISTICS OF CANDIDATE WATERSHED AREAS

	Topography	Soils	Drainage Network	Under-Drainage
ESSEX	Flat plain, slopes < 2%.	Poorly drained clay soils.	Extensive network of open municipal drains and roadside ditches. No buried drains.	Majority of cropland is systematically tile drained.
KETTLE	Rolling landscape with long gentle slopes, 2-4%.	Predominantly silt loam textures, ranging to loams in the east and clay loams in the west. Poorly drained soils in the east and along drains, well to imperfectly drained elsewhere.	Primarily open channels. Municipal drains only in the central basin with the top ends of three branches being buried drains.	Random tile drainage indicated for about 50% of croplands.
SPITTLER	Strongly undulating with 8%+ slopes in upper basin. Gently sloping with 2-3% slopes towards the outlets.	Clay loam textures in upper basin areas changing to silt loam towards the outlets. Good drainage on clay loams and imperfect drainage on most of the silt loam soils. Area of much found along one drain.	All channels are municipal drains. Tributaries and upper reaches are closed drains.	Extensive random tile drainage to the west, some random and systematic to the east.
PITTOCK	Undulating landscape with 2-5% slopes.	Imperfectly drained silt loam soils with poorly drained pockets.	All municipal drains. Most of the drains are closed, open sections found only at the outlets.	Systematic tile drainage on over half the cropland, being more relevant to the north.
WHIRL CR.	Long gentle slopes, 1-3%.	Imperfectly drained silt loam to clay loam textured soils with alluvial materials along drainage ways.	Channels are primarily open municipal drains with certain tributaries enclosed.	Mix of random and systematic tile drainage on about half the cropland.

TABLE 2.4: SUMMARY OF FARM OPERATOR INTERVIEWS

	Essex	Kettle	Spittler	Pittock	Whirl Cr.
No. of sub-watersheds	4	3	2	2	2
No. of operators	40	28	26	30	28
No. of operators interviewed	36	26	23	27	23
(Response rate)	90%	90%	88%	90%	82%
Average size of sub-watersheds (ha)	354	329	486	351	425
Sub-watershed area worked by interviewed operators	320	320	457	326	343
(ha and % of total)	91%	97%	94%	93%	81%
Non-farm properties in the study area	46	14	7	6	11

TABLE 2.5: GENERAL DESCRIPTION OF FARM OPERATIONS IN SUB-WATERSHED AREAS

	Essex	Kettle	Spittler	Pittock	Whirl Cr.
Average farm size (ha)	160	138	154	101	81
Average farm hectare within each sub-watershed	37	36	40	24	30
No. of operators in each sub-watershed	10	10	13	15	14
No. of headquarter property in each sub-watershed	7	5	8	10	10
No. of owner/operators in each sub-watershed	7	7	8	12	12
Principal type of enterprise	cash crops	cash crops, swine	cash crop, swine	dairy, swine	swine
Principal type of crop rotation	row crops/ grain	row crops/ grain	row crops/ grain	corn/hay	row crops/ grain

TABLE 2.6: EXISTING USE OF CONVENTIONAL AND CONSERVATION PRACTICES IN SUB-WATERSHED AREAS

	Essex	Kettle	Spittler	Pittock	Whirl Cr.
Percentage of operators using the following crop management practices:					
fall moldboard	82	64	65	70	82
spring moldboard	0	0	9	15	0
chisel	6	5	9	0	0
chisel & moldboard	20	31	17	15	18
cross slope till	6	0	8	13	4
cover crops	69	58	35	43	57
rotations	9	27	65	52	83
lift plough in waterways	0	27	19	4	9
No. of structures in each sub-watershed:					
grassed waterway	0	4	1	1	1
other structures	6	4	3	3	5

TABLE 2.7: PERCEPTIONS OF SOIL CONSERVATION ISSUES

	Essex	Kettle	Spittler	Pittock	Whirl Cr.
Percentage of operators in each sub-watershed:					
Identifying erosion as a problem on their farm	40	54	39	22	22
Identifying other soil problems on their farm	46	62	35	22	39
Planning to try soil conservation measures	43	54	13	41	26
Having contacted OMAF or C.A.'S regarding soil conservation	30	50	30	4	30

TABLE 2.8: SECOND OPERATOR INTERVIEWS, PWS

	Kettle	Pittock	Essex*
Number of interviews completed	20	26	21
Response rate	91%	87%	88%
Watershed Area (ha)			
Test	360	336	350
Control	324	316	296
Hectares accounted for in interviews			
Test	333 92%	328 98%	330 94%
Control	324 100%	255 81%	247 84%

* Essex figures are from sub-watersheds A & C

TABLE 3.1: PWS WATERSHED FEATURES

Study Area	Area (ha)	Predominant Soil Types	Drainage	Major Watershed	Predominant Farming Systems	Landscape	Erosion Potential
Essex Test	435	Brookston Clay	Poor, Extensive Sub-Surface Tile Systems	Puce R.	Grain corn, soybeans, winter wheat	Gently undulating, less than 1% slopes	High
Essex Control	281	Brookston Clay	Poor, Extensive Sub-surface Tile System	Belle R.	Grain corn, soybeans, winter wheat	Gently undulating, less than 1% slopes	High
Kettle Creek Test	410	Muriel soils, silty clay and silty clay loam	Imperfect, random sub-surface tile systems	Kettle Creek	Grain corn, soybeans, winter wheat, dairy, beef, hogs	Complex, rolling 2-8% slopes	Moderately High
Kettle Creek Control	354	Muriel soils, silty clay and silty clay loam	Imperfect, random sub-surface tile systems	Kettle Creek	Grain corn, soybeans, winter wheat, dairy, beef, hogs	Complex, rolling 2-6% slopes	Moderately High
Pittock Test	359	Oxford Till, silty loam	Good to imperfect, extensive and random sub-surface tile systems	Thames R.	Grain corn, beans, winter wheat, dairy	Gently rolling, 2-4% slopes	Medium
Pittock Control	384	Oxford Till, silty loam	Good to imperfect, extensive and random sub-surface tile systems	Thames R.	Grain corn, beans, winter wheat, dairy	Gently rolling, 2-4% slopes	Medium

TABLE 3.2: MICROBASIN CHARACTERISTICS

Microbasin	Area (ha)	Slope (%)	Predominant Soil Type
ETB1	5.3	0-1	Clay
ETB2	6.1	0-1	Clay
ECB1	8.2	0-1	Clay
ECB2	13.8	0-1	Clay
KTB1	6.5	3.5	Silty Clay Loam
KTB2	5.1	1.7	Silt Loam
KCB1	8.5	2.5	Silt Loam
KCB2	4.1	2.6	Silty Clay Loam
PTB1	24.8	0.70	Silty Loam
PTB2	28.0	0.26	Silty Loam
PCB1	12.8	1.0	Silty Loam
PCB2	20[1]	0.38	Silty Loam

[1] The presence of a drop inlet in this microbasin makes the area estimate approximate

TABLE 4.1: METEOROLOGICAL INSTRUMENTATION IN THE PILOT WATERSHED STUDY

Instruments	Essex	Kettle	Pittock
Automatic Sensors[1]			
Windspeed and direction	*(5)	*(5)	*(15)
Air temperature	*(15)	*(60)	*(15)
Heated tipping bucket raingauge	*(15)	*(10)	*(15)
Solar radiation	*(15)	*(10)	*(15)
Manually Read Instruments			
Evaporation pan	*	*	*
Standard rain gauges (3)	*	*	*
Soil moisture apparatus	*	*	*
Data Logger Type			
HANDAR	*	*	
Memodyne			*
b) Secondary Weather Stations			
Automatic Sensors[1]			
Air temperature	*(60)	*(60)	*(60)
Tipping bucket raingauge	*(60)	*(60)	*(60)
Relative humidity		*(60)	
Standard raingauge	*	*	*
Model communication link	*	*	*
Campbell data logger	*	*	*

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[1] Automatic sampling frequency in minutes noted in brackets ( ).

Table 4.2: Alternate Sources of Meteorological Data for Augmentation of Data Base

Watershed	Alternate Data Source	Data Available
Pittock	- London Airport (AES)	- hourly rainfall and temperature - snowfall (every 6 hours) - solar radiation
	- Woodstock WPCP (AES)	- daily air temperature and precipitation
	- Stratford MOE (AES)	- daily air temperature and precipitation - hourly rainfall (April 1 to October 31)
	- UTRCA - Avon and Innerkip	- hourly air temperature and precipitation
Kettle Creek	- London Airport (AES)	- hourly rainfall and temperature - snowfall (every 6 hours) - solar radiation
	- Westminster Township (AES)	- daily air temperature and precipitation
	- St. Thomas WPCP (AES)	- daily air temperature and precipitation - hourly rainfall (April 1 to October 31)
	- KCCA - Office Gauges	- hourly precipitation
Essex	- Woodslee Research Station (Agriculture Canada)	- hourly precipitation, temperature, wind speed and direction, solar radiation, humidity
	- Windsor Airport (AES)	- hourly air temperature and precipitation - snowfall (every 6 hours)

AES	Atmospheric Environment Service
WPCP	Water Pollution Control Plant
UTRCA	Upper Thames River Conservation Authority
KCCA	Kettle Creek Conservation Authority

Table 4.3: Comparison of 1989 to 1992 Average Monthly Air Temperatures with Longterm Normals

Temperature (Degrees C)

	Essex					Kettle Creek					Pittock				
Month	1989	1990	1991	1992	Normal*	1989	1990	1991	1992	Normal*	1989	1990	1991	1992	Normal*
January	0.7	0.3	-4.9	-3.2	-5.4	-2.2	-1.3	-5.7	-4.1	-6.3	-2.9	-1.8	-6.6	-6.8	-6.6
February	-3.6	-1.1	-1.9	-1.9	-4.3	-6.5	-3.0	-2.3	-3.5	-6.5	-7.4	-4.0	-3.3	-4.6	-5.8
March	0.6	2.5	2.3	-0.1	0.9	-1.0	1.5	1.4	-0.9	-0.3	-2.1	0.7	0.5	-1.5	-0.9
April	5.5	8.1	6.0	5.9	7.9	4.6	7.7	8.4	5.0	6.3	4.8	8.0	8.3	4.6	6.3
May	12.8	12.8	18.1	13.6	13.9	12.6	11.7	16.6	12.9	12.6	12.8	11.6	16.8	12.6	12.4
June	19.1	19.6	21.8	17.5	19.4	17.8	17.6	19.9	15.9	17.9	18.2	17.2	19.9	15.6	17.8
July	22.2	21.4	22.6	-	21.6	20.9	20.2	20.6	-	20.3	21.2	19.7	20.4	-	20.1
August	20.6	20.3	21.1	-	20.8	18.9	18.9	20.0	-	19.8	19.0	18.5	19.6	-	19.3
September	16.1	16.5	16.9	-	17.1	14.9	14.7	14.9	-	15.8	14.7	14.2	14.3	-	15.4
October	10.8	10.8	11.9	-	10.9	9.4	9.1	10.1	-	9.7	9.4	8.6	9.7	-	9.4
November	3.1	6.0	3.1	-	4.2	1.8	4.5	1.9	-	3.5	1.1	4.1	3.4	-	3.0
December	-8.4	-0.6	-0.9	-	-2.2	-9.6	-1.2	-2.1	-	-3.2	-10.4	-1.9	-2.9	-	-3.4
Annual Average	8.3	9.7	9.7	-	8.7	6.8	8.4	8.6	-	7.5	6.5	7.9	8.3	-	7.3

* AES 1951 to 1980

Table 4.4: Maximum Air Temperatures (1989 to 1992)

Temperature (Degrees C)

	Essex				Kettle Creek				Pittock			
Month	1989	1990	1991	1992	1989	1990	1991	1992	1989	1990	1991	1992
January	14.0	11.1	3.6	5.8	10.2	8.5	3.5	4.2	10.1	7.2	3.0	23.0
February	9.1	14.8	10.2	6.8	8.5	9.5	8.8	4.9	9.1	8.9	7.0	3.4
March	23.0	21.4	19.7	14.2	19.3	23.0	16.9	12.8	20.8	22.6	16.7	13.0
April	17.7	28.6	21.9	22.2	19.7	28.2	24.2	22.1	19.1	28.5	24.9	21.2
May	27.0	24.0	31.7	28.5	26.0	23.3	29.7	27.8	26.6	23.8	29.9	27.7
June	31.5	32.0	32.9	31.2	31.0	28.7	30.1	28.7	29.8	29.6	30.6	28.5
July	33.7	35.3	33.4	-	31.1	34.9	32.6	-	30.5	34.0	32.2	-
August	30.5	32.0	32.2	-	28.2	28.7	31.6	-	29.1	27.7	31.2	-
September	29.2	29.8	32.4	-	28.7	26.4	31.6	-	27.2	26.6	31.0	-
October	26.8	26.9	26.4	-	22.1	23.3	24.2	-	23.3	23.6	24.8	-
November	18.5	20.4	15.7	-	16.1	20.5	15.4	-	16.3	19.9	15.0	-
December	4.0	10.6	12.5	-	3.9	11.0	11.7	-	4.2	11.6	12.3	-
Annual Maximum	33.7	35.3	33.4	31.2	31.1	34.9	32.6	28.7	30.5	34.0	32.2	28.5

Table 4.5: Minimum Air Temperatures (1989 to 1992)

Temperature (Degrees C)

	Essex				Kettle Creek				Pittock			
Month	1989	1990	1991	1992	1989	1990	1991	1992	1989	1990	1991	1992
January	-12.3	-10.7	-15.9	-19.9	-19.3	-12.9	-17.9	-20.2	-21.1	-10.2	-18.7	-23.6
February	-15.8	-15.0	-15.8	-15.8	-17.9	-21.9	-15.3	-20.3	-20.3	-19.1	-20.8	-23.7
March	-12.7	-11.6	-13.8	-13.7	-17.0	-11.3	-10.1	-13.7	-19.9	-13.6	-11.9	-14.8
April	-7.2	-6.8	-4.6	-5.8	-7.5	-5.3	-3.8	-6.0	-7.2	-5.7	-2.7	-6.1
May	1.0	3.4	3.3	2.7	0.7	0.4	0.7	0.7	0.3	-1.4	2.0	1.1
June	8.9	7.8	10.8	6.1	7.8	2.8	6.0	1.8	7.7	3.8	6.8	2.4
July	11.6	11.2	9.2	-	8.8	9.3	8.8	-	9.0	10.2	7.3	-
August	9.1	11.1	8.5	-	7.4	9.5	8.5	-	6.9	8.4	10.2	-
September	1.0	4.1	1.4	-	-1.7	1.4	-1.7	-	0.3	1.8	0.1	-
October	-2.4	-0.1	0.0	-	-0.7	-2.8	-3.1	-	-0.7	0.1	0.1	-
November	-9.1	-2.7	-9.4	-	-9.0	-4.6	-9.8	-	-11.2	-5.6	-8.7	-
December	-23.7	-15.9	-13.6	-	-20.7	-16.6	-18.3	-	-19.5	-17.3	-20.0	-
Annual Minimum	-23.7	-15.9	-15.9	-19.9	-20.7	-21.9	-18.3	-20.3	-21.1	-19.1	-20.8	-23.7

Table 4.6: Summary of Meteorological Extremes (1989 to 1992)

Parameter	Watershed		
	Essex	Kettle	Pittock
Highest Daily Average Wind Speed (m/s)	20.3	17.3	14.8
Date of Occurence	April 15, 1991	Jan. 25, 1990	Jan. 25, 1990
Lowest Air Temperature (deg.C)	-23.7	-20.7	-23.7
Date of Occurence	Dec. 22, 1989	Dec. 22, 1989	Feb. 12, 1992
Highest Air Temperature (deg. C)	35.3	34.9	34.0
Date of Occurence	July 04, 1990	July 04, 1990	July 04, 1990
Highest Daily Precipitation (mm)	65.7	95.6	63.3
Date of Occurence	Sept. 06, 1990	Aug. 28, 1990	July 08, 1990
Highest Hourly Precipitation (mm)	31.8	66.52	27.28
Date of Occurence	June 19, 1989	Aug. 28, 1990	July 08, 1990
Time of Occurence	1700 hrs	1600 hrs	2300 hrs

Table 4.7: Corn Heat Units During Growing Season (1989-1991)

	CORN HEAT UNITS			
Location	1989	1990	1991	Normal*
Essex	3,150	3,132	3,450	3,400
Kettle Creek	2,774	2,640	2,945	2,900
Pittock	2,597	2,464	2,774	2,700

* Approximate longterm means (O.M.A.F.)

Table 4.8: Average Monthly Air and Soil Temperatures: 1989

Temperature (Deg. C)

Location	Essex				Kettle Creek				Pittock			
	Air	Soil	Soil	Soil	Air	Soil	Soil	Soil	Air	Soil	Soil	Soil
Depth (cm)		5	50	150		5	50	150		5	50	150
January	0.7	NA	NA	NA	-2.2	-0.9	1.9	4.2	-2.9	-0.6	1.0	4.3
February	-3.6	NA	NA	NA	-6.5	-1.8	1.5	3.3	-7.4	-2.1	0.2	3.3
March	0.6	3.1	4.8	3.4	-1.0	1.1	1.3	2.4	-2.1	0.2	-0.3	2.5
April	5.5	6.0	5.8	5.1	4.6	6.6	5.2	4.1	4.8	5.4	2.7	2.7
May	12.8	13.5	10.9	8.3	12.6	13.9	9.8	7.1	12.8	12.8	9.5	5.7
June	19.1	19.5	16.8	12.7	17.8	18.2	14.9	11.3	18.2	18.3	14.8	9.8
July	22.2	22.5	19.9	16.0	20.9	17.9	17.1	13.2	21.2	21.6	17.1	12.9
August	20.6	22.5	20.7	17.8	18.9	19.1	17.2	14.4	19.0	19.2	16.9	14.2
September	16.1	18.8	18.7	18.0	14.9	14.5	15.9	14.2	14.7	15.5	15.4	14.2
October	10.8	12.1	13.2	15.2	9.4	9.0	12.1	12.1	9.4	8.9	10.6	12.1
November	3.1	5.0	8.1	11.9	1.8	4.3	9.1	9.7	1.1	3.6	6.7	9.6
December	-8.4	-0.5	2.6	7.6	-9.6	0.3	5.3	6.8	-10.4	-0.5	2.3	6.3

Table 4.9: Average Monthly Air and Soil Temperatures: 1990

Temperature (Deg.C)

Watershed	Essex				Kettle				Pittock			
Location	Air	Soil	Soil	Soil	Air	Soil	Soil	Soil	Air	Soil	Soil	Soil
Depth (cm)		5	50	150		5	50	150		5	50	150
January	0.3	0.5	1.5	5.0	-1.3	0.3	2.4	3.9	-1.8	-0.1	1.4	4.3
February	-1.1	1.2	2.1	4.7	-3.0	0.2	2.4	2.9	-4.0	-0.3	1.3	3.4
March	2.5	4.5	3.9	5.0	1.5	2.4	4.3	3.5	0.7	0.7	1.0	2.9
April	8.1	8.9	6.7	6.3	7.7	8.0	6.6	4.8	8.0	7.3	4.2	3.6
May	12.8	14.7	12.4	10.1	11.7	12.1	11.3	8.4	11.6	11.3	9.4	7.1
June	19.6	19.3	16.3	13.1	17.6	15.4	13.6	10.5	17.2	16.8	12.8	9.8
July	21.4	22.3	19.5	16.0	20.2	17.5	16.4	12.9	19.7	20.4	16.5	12.7
August	20.3	21.7	20.1	17.6	18.9	17.0	16.8	14.2	18.5	19.2	17.4	14.5
September	16.5	18.9	18.8	18.1	14.7	14.7	16.5	14.8	14.2	15.1	15.3	14.5
October	10.8	12.2	13.7	15.5	9.1	9.8	12.9	12.7	8.6	9.7	11.6	12.6
November	6.0	6.8	8.8	12.1	4.5	4.9	8.9	9.5	4.1	5.0	7.0	9.6
December	-0.6	2.6	4.9	8.9	-1.2	1.2	5.0	6.1	-1.9	1.4	4.0	7.0

Table 4.10: Average Monthly Air and Soil Temperatures: 1991

Temperature (Deg.C)

Watershed	Essex				Kettle				Pittock			
Location	Air	Soil	Soil	Soil	Air	Soil	Soil	Soil	Air	Soil	Soil	Soil
Depth (cm)		5	50	150		5	50	150		5	50	150
January	-4.9	-0.0	2.1	6.2	-5.7	-0.3	3.1	3.9	-6.6	-0.4	1.9	4.8
February	-1.9	0.1	1.1	4.5	-2.3	-0.2	2.1	2.6	-3.3	-0.2	1.4	3.7
March	2.3	3.7	3.0	4.5	1.4	2.2	3.3	2.5	0.5	0.6	1.3	3.1
April	6.0	9.8	7.6	6.9	8.4	9.0	7.6	5.5	8.3	7.4	5.4	4.5
May	18.1	18.3	14.1	10.5	16.6	15.4	11.9	8.4	16.8	14.1	10.4	7.6
June	21.8	22.8	19.2	15.2	19.9	16.8	15.1	11.7	19.9	18.1	14.4	11.4
July	22.6	25.3	22.1	17.9	20.6	17.7	16.4	13.4	20.4	20.2	16.9	13.7
August	21.1	24.0	22.2	19.3	20.0	18.0	16.7	14.3	19.6	19.2	16.9	14.7
September	16.9	19.7	20.4	19.3	14.9	15.2	16.7	15.1	14.3	14.6	15.4	14.7
October	11.9	12.7	14.7	16.1	10.1	10.5	12.7	12.8	9.7	9.6	10.9	12.4
November	3.1	5.0	8.3	12.4	1.9	4.0	9.0	10.2	3.4	3.3	6.5	9.8
December	-0.9	2.3	4.9	9.1	-2.1	1.5	5.7	7.1	-2.9	1.2	3.6	7.2

Table 4.11: Average Monthly Air and Soil Temperatures: 1992

Temperature (Deg.C)

Watershed	Essex				Kettle				Pittock			
Location	Air	Soil	Soil	Soil	Air	Soil	Soil	Soil	Air	Soil	Soil	Soil
Depth (cm)		5	50	150		5	50	150		5	50	150
January	-3.2	1.4	3.1	6.7	-4.1	0.5	3.3	4.6	-6.8	0.3	2.3	5.3
February	-1.9	0.9	2.1	5.3	-3.5	0.0	2.2	3.0	-4.6	0.1	1.7	4.1
March	-0.1	2.8	3.2	5.2	-0.9	0.8	3.2	3.1	-1.5	-0.3	1.3	3.4
April	5.9	7.8	6.3	6.1	5.0	6.3	6.0	4.5	4.6	4.0	2.9	3.6
May	13.6	14.6	11.8	9.5	12.9	14.8	11.4	8.3	12.6	11.0	8.7	6.7
June	17.5	18.0	15.7	12.6	15.9	17.8	13.9	10.8	15.6	13.5	11.4	9.5

Table 4.12: Comparison of 1989 to 1992 Monthly Total Precipitation with Longterm Normals

Precipitation (mm)

	Essex					Kettle					Pittock				
Month	1989	1990	1991	1992	Normal#	1989	1990	1991	1992	Normal*	1989	1990	1991	1992	Normal@
January	31.4	38.4	6.1	11.3	51.2	19.3	55.8	9.5	27.0	67.1	25.7	19.4	6.9	15.2	60.2
February	12.6	73.5	3.6	44.0	45.7	2.0	85.3	4.0	52.5	57.1	14.0	55.1	10.5	30.7	49.9
March	33.2	7.6	11.0	56.4	70.1	26.3	37.5	68.1	36.2	71.5	6.0	31.1	74.4	20.2	70.1
April	72.9	59.1	71.3	86.7	80.4	60.3	54.2	57.6	92.1	76.5	51.7	43.6	78.2	94.6	76.2
May	124.1	97.9	109.9	35.3	72.7	91.2	106.8	61.6	29.9	74.5	84.7	94.9	57.4	62.6	64.8
June	130.8	82.9	33.1	60.6	97.4	80.2	75.8	28.5	60.2	86.4	80.4	63.7	22.5	45.8	82.0
July	91.1	82.1	12.0	-	88.6	72.7	131.5	46.0	-	82.5	51.7	149.7	107.9	-	75.4
August	36.8	133.4	62.0	-	82.1	27.3	176.3	52.7	-	98.3	42.3	105.9	48.4	-	88.4
September	85.1	167.9	28.1	-	80.7	53.4	107.2	20.2	-	82.8	28.6	98.1	37.7	-	74.2
October	40.3	83.7	138.0	-	52.2	64.4	88.7	101.5	-	74.0	62.2	110.1	66.7	-	73.8
November	63.8	56.1	63.1	-	74.1	78.5	80.5	67.7	-	90.1	99.9	88.6	66.2	-	71.7
December	26.2	68.7	26.1	-	80.3	24.5	90.6	25.9	-	90.2	12.6	74.4	17.1	-	74.9
Annual Total	748.2	951.2	564.2	294.4	875.5	600.0	1090.1	543.4	297.9	951.0	559.7	934.6	593.7	269.0	861.6

AES 1946 to 1988
* AES 1961 to 1990
@ AES 1951 to 1980

Table 4.13: Maximum Hourly Precipitation (1989 to 1992)

Precipitation (mm)

	Essex				Kettle Creek				Pittock			
Month	1989	1990	1991	1992	1989	1990	1991	1992	1989	1990	1991	1992
January	3.7	4.2	0.8	1.6	2.7	4.1	1.1	4.0	4.0	2.5	0.8	1.8
February	1.6	6.7	0.8	6.6	0.7	6.4	1.3	9.8	2.7	3.8	1.1	4.6
March	1.6	1.3	1.3	5.9	5.0	4.0	4.5	4.2	0.5	2.5	3.2	3.0
April	5.0	4.4	3.5	6.0	4.9	2.6	4.0	12.2	3.9	2.2	9.1	10.3
May	22.6	7.6	19.9	6.1	15.7	8.1	8.6	3.7	12.6	7.1	5.6	18.5
June	31.8	10.4	16.8	15.1	10.7	10.4	5.1	8.0	14.4	8.4	3.0	7.1
July	20.0	11.5	6.9	-	32.8	19.7	13.6	-	13.5	27.3	12.6	-
August	9.0	22.0	6.0	-	5.4	66.5	15.8	-	14.9	21.9	10.8	-
September	9.7	28.5	9.6	-	7.2	20.9	4.1	-	3.5	11.7	10.8	-
October	5.3	8.1	10.7	-	4.3	12.3	13.4	-	6.3	8.8	4.3	-
November	11.3	4.2	6.3	-	5.5	5.7	5.7	-	10.8	4.1	7.1	-
December	3.1	3.5	2.4	-	5.0	4.4	3.1	-	1.4	3.8	5.5	-
Annual Maximum	31.8	28.5	19.9	15.1	32.8	66.5	15.8	12.2	14.9	27.3	12.6	18.5

Table 4.14: Maximum Daily Precipitation (1989 to 1992)

	Precipitation (mm)											
	Essex				Kettle Creek				Pittock			
Month	1989	1990	1991	1992	1989	1990	1991	1992	1989	1990	1991	1992
January	11.5	15.5	4.6	3.1	5.0	16.1	4.5	13.7	8.9	8.4	3.0	8.1
February	7.3	58.2	2.3	18.6	1.5	56.1	2.1	27.0	5.8	38.4	5.0	19.8
March	3.1	1.8	2.3	14.0	12.6	8.6	19.6	11.2	3.8	7.2	20.9	8.4
April	18.5	22.3	24.4	17.0	12.0	20.1	11.4	44.9	9.2	17.6	16.9	51.2
May	36.0	27.4	35.3	12.5	21.8	28.8	35.0	9.4	25.4	19.4	11.5	23.2
June	38.8	23.3	19.8	31.5	19.0	21.6	15.4	20.7	21.9	20.8	11.1	14.3
July	46.9	31.4	8.1	-	45.6	32.5	21.2	-	28.5	63.3	30.2	-
August	18.6	35.5	24.2	-	10.0	95.6	19.5	-	27.1	36.5	17.1	-
September	17.7	65.7	16.6	-	19.7	33.0	7.6	-	7.1	34.8	18.4	-
October	14.3	27.6	37.7	-	29.7	25.3	33.8	-	33.4	25.3	17.0	-
November	27.9	21.5	22.3	-	19.7	44.8	19.1	-	42.0	49.1	19.3	-
December	25.6	23.2	7.9	-	19.8	36.0	11.4	-	7.7	36.1	7.5	-
Annual Maximum	46.9	65.7	37.7	31.5	45.6	95.6	35.0	44.9	42.0	63.3	30.2	51.2

TABLE 4.15: NUMBER OF SIGNIFICANT PRECIPITATION EVENTS OBSERVED, 1989-92

	Intensity (cm/d)	Essex	Kettle Creek	Pittock
1989	2.0 to 4.0	7	2	5
	>4.0 to 6.0	1	1	1
	>6.0	0	0	0
1990	2.0 to 4.0	15	12	7
	>4.0 to 6.0	1	2	1
	>6.0	1	1	1
1991	2.0 to 4.0	8	4	3
	>4.0 to 6.0	0	0	0
	>6.0	0	0	0
1992*	2.0 to 4.0	1	2	1
	>4.0 to 6.0	0	1	1
	>6.0	0	0	0

* January to June only

Table 4.16: Total Monthly Evaporation (1989 to 1992)

Evaporation (mm)

	Essex				Kettle				Pittock			
Month	1989	1990	1991	1992	1989	1990	1991	1992	1989	1990	1991	1992
January	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
February	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
March	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
April	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
May	144.3	144.9	255.2	150.1	NA	121.5	125.9	129.6	NA	160.4	119.5	NA
June	153.1	138.9	145.5	217.2	129.2	138.8	164.6	169.5	178.1	196.5	248.9	NA
July	174.0	149.1	236.0	-	161.3	188.8	181.8	-	167.9	217.2	134.4	-
August	196.0	136.3	158.9	-	99.1	153.1	194.5	-	119.2	108.9	151.7	-
September	83.9	122.9	127.5	-	89.3	93.0	93.7	-	92.1	144.6	156.2	-
October	106.3	82.7	224.0	-	39.5	42.1	90.7	-	85.2	56.1	81.2	-
November	NA	NA	NA	-	NA	NA	NA	-	NA	NA	NA	-
December	NA	NA	NA	-	NA	NA	NA	-	NA	NA	NA	-
Annual Total	857.6	774.8	1147.1	367.3	518.4	737.3	851.2	299.1	642.5	883.7	891.9	NA

Table 4.17: Comparison of 1989 to 1992 Average Monthly Wind Speed with Longterm Normals

Windspeed (m/s)

	Essex					Kettle					Pittock				
Month	1989	1990	1991	1992	Normal	1989	1990	1991	1992	Normal	1989	1990	1991	1992	Normal
January	5.4	1.9	4.8	2.5	5.6	4.7	4.4	3.9	3.5	5.5	5.3	4.7	2.0	1.7	4.3
February	5.0	1.7	4.3	1.4	5.5	4.2	3.5	3.1	3.1	5.1	4.4	3.4	1.7	1.7	4.1
March	4.9	4.7	5.3	1.8	5.7	3.8	1.9	3.5	4.1	5.2	3.6	3.8	1.8	1.8	4.4
April	4.0	4.5	2.6	2.1	5.5	3.3	3.4	3.7	3.5	5.1	2.7	3.8	1.7	3.5	4.4
May	4.0	4.5	1.5	2.1	4.8	3.6	3.8	2.4	3.1	4.4	3.6	3.5	1.2	3.1	3.5
June	2.8	2.0	1.6	0.8	4.1	2.0	3.5	2.1	3.2	3.8	2.7	3.8	0.9	3.2	3.3
July	2.7	3.3	2.5	-	3.6	1.4	1.4	2.3	-	3.3	2.1	2.3	1.0	-	2.8
August	2.8	2.5	2.1	-	3.5	1.6	2.0	2.6	-	3.2	2.2	1.7	1.0	-	2.6
September	2.9	3.0	2.3	-	3.8	1.7	2.3	2.4	-	3.6	2.2	2.1	1.3	-	2.8
October	3.9	4.3	3.6	-	4.4	2.1	3.3	3.0	-	4.1	2.8	3.4	1.6	-	3.2
November	5.5	4.5	4.2	-	5.1	3.9	3.7	3.5	-	4.9	4.7	4.3	1.8	-	4.0
December	4.2	4.6	2.8	-	5.2	3.2	3.8	3.3	-	5.1	3.6	4.2	1.7	-	4.0
Annual Average	4.0	3.5	3.1	1.8	4.7	3.0	3.1	3.0	3.4	4.4	3.3	3.4	1.5	2.5	3.6

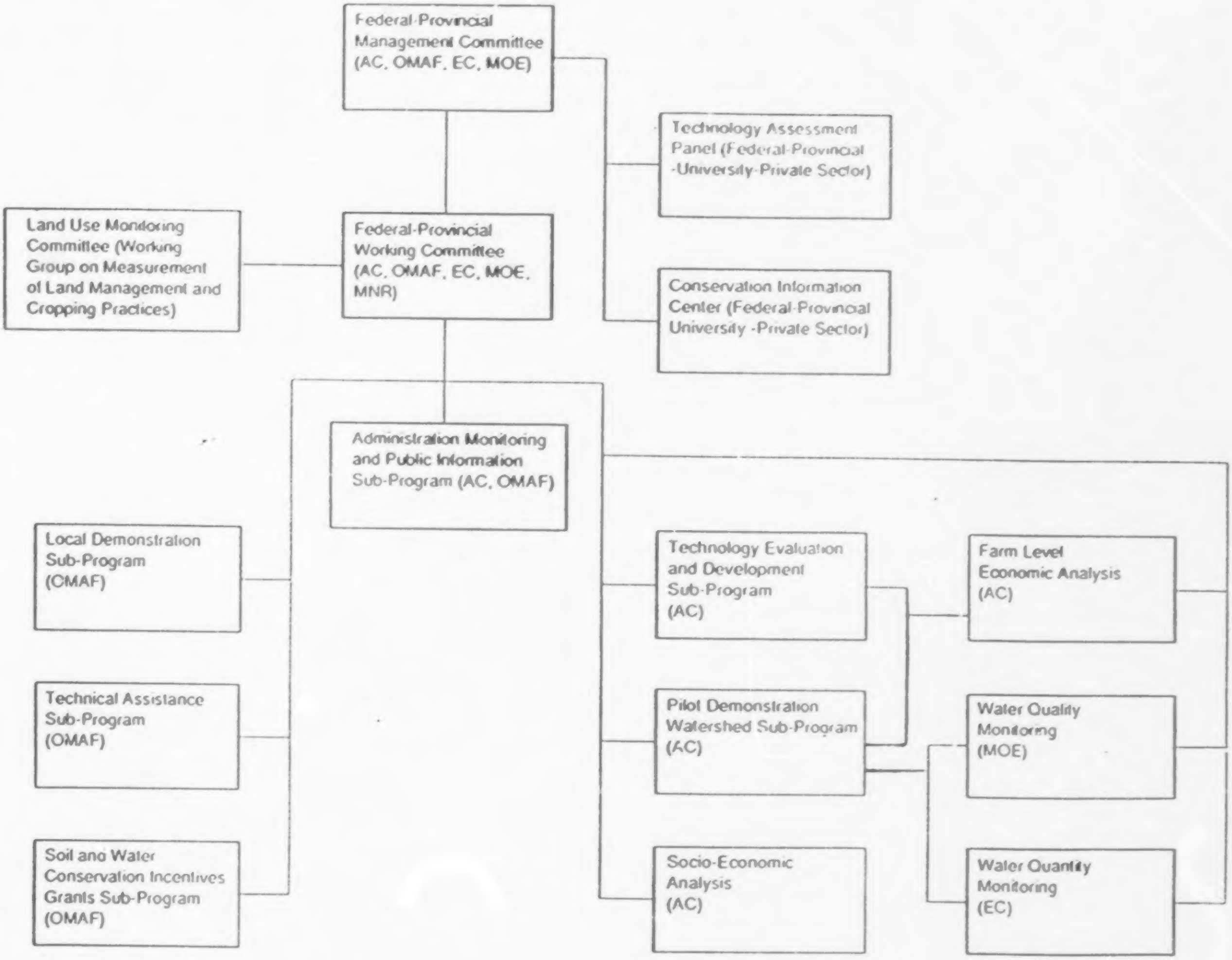
Table 4.18: Maximum Wind Speeds (1989 to 1992) in Comparison to Longterm Normals

	Windspeed (m/s)														
	Essex					Kettle					Pittock				
Month	1989	1990	1991	1992	Normal	1989	1990	1991	1992	Normal	1989	1990	1991	1992	Normal
January	14.4	6.3	14.6	13.8	20.0	12.7	17.3	11.3	15.0	27.8	13.1	14.8	5.2	5.3	18.6
February	13.7	6.3	11.5	7.6	21.4	11.9	12.9	10.3	13.4	18.9	12.1	10.2	4.3	7.7	15.6
March	14.6	13.6	17.6	9.4	25.6	13.1	8.8	13.9	13.3	25.8	11.3	10.8	5.6	6.3	16.1
April	9.4	10.2	20.3	11.0	22.2	9.9	11.8	14.4	10.3	19.2	9.9	10.8	5.9	10.3	16.1
May	11.5	17.2	3.7	12.5	21.9	10.0	12.8	8.9	12.9	24.7	9.5	14.5	4.1	12.9	19.7
June	8.3	5.9	6.9	12.1	15.6	10.8	11.4	8.7	9.3	22.2	8.4	13.2	3.0	9.3	13.1
July	9.0	9.9	7.9	–	17.8	8.6	6.9	7.7	–	15.6	9.6	9.0	3.0	–	13.3
August	8.5	8.3	9.0	–	17.8	7.9	7.5	9.4	–	15.6	8.3	6.3	3.1	–	11.4
September	11.2	10.9	9.5	–	23.6	9.2	9.4	8.7	–	16.1	8.8	8.2	4.8	–	11.7
October	11.4	13.8	12.9	–	20.0	10.8	10.6	10.8	–	15.3	9.5	10.7	4.8	–	11.7
November	16.0	14.4	16.0	–	19.2	13.6	10.3	13.4	–	20.0	11.6	13.3	5.6	–	18.3
December	10.6	13.1	19.5		21.9	9.8	13.3	12.1		18.9	10.4	14.5	7.4		14.7
Annual Maximum	16.0	17.2	20.3	13.8	25.6	13.6	17.3	14.4	15.0	27.8	13.1	14.8	7.4	12.9	19.7

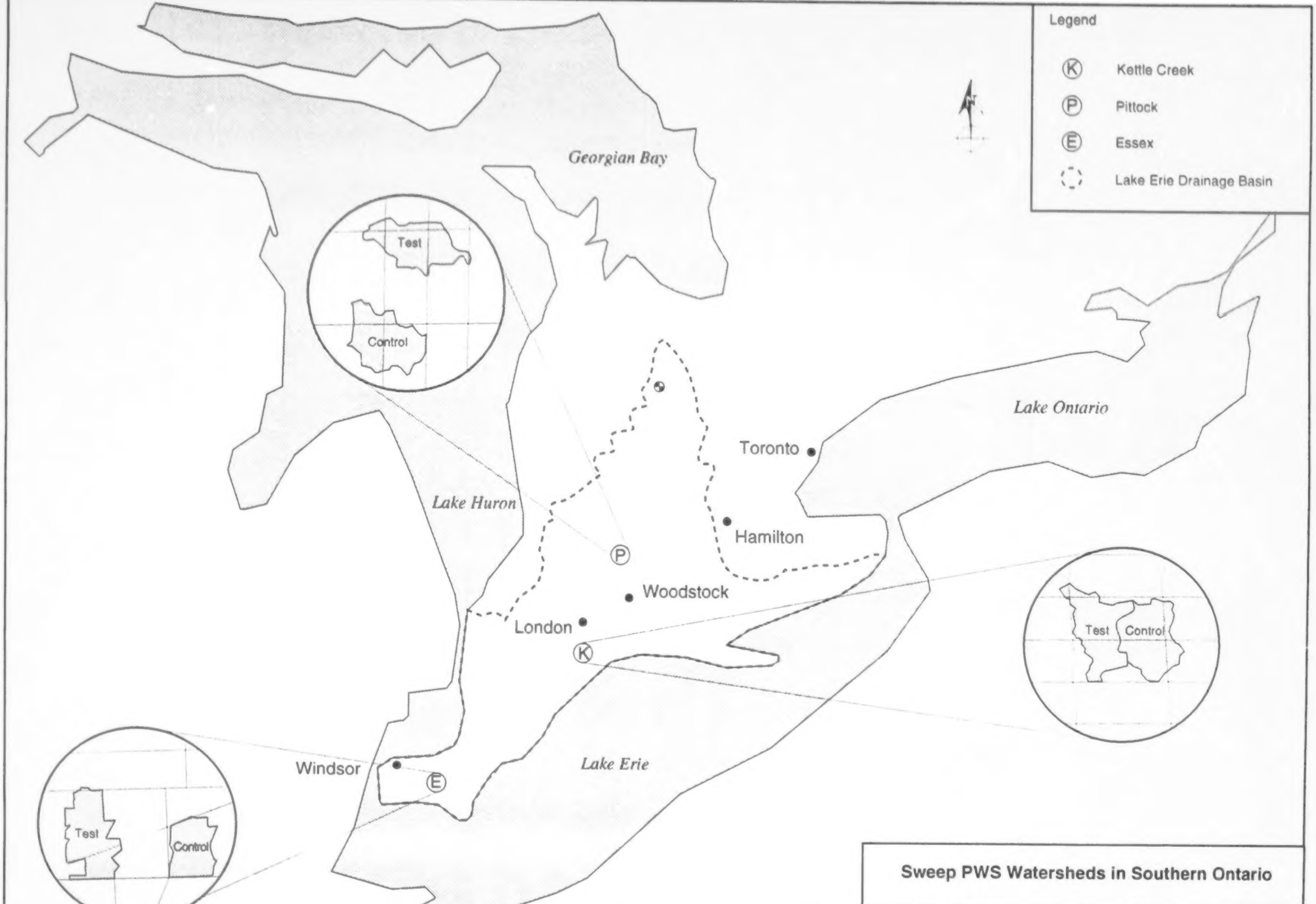
Table 4.19: Total Monthly Solar Radiation for 1989 to 1992

	Solar Radiation (Langleys)											
	Essex				Kettle				Pittock			
Month	1989	1990	1991	1992	1989	1990	1991	1992	1989	1990	1991	1992
January	4561	3808	4673	3882	3946	3808	7170	4293	3719	3190	4090	6389
February	6245	5885	5825	6157	6128	5885	6298	6157	5604	5605	5359	6157
March	9820	9264	9929	9640	9903	9552	8546	9135	9750	8591	7925	9573
April	12329	13188	10606	10678	11641	11537	8841	9298	10442	10810	8876	-
May	14455	15369	15375	17257	13090	13958	10110	14896	11880	12825	13954	-
June	14619	14736	18480	17439	14314	11275	13368	15638	12457	13761	15716	-
July	15216	17156	18554	-	17831	11240	14291	-	15678	14476	15557	-
August	14217	13886	16020	-	13679	7468	13637	-	12568	11545	13021	-
September	10460	11479	11699	-	10359	8794	15534	-	9291	8706	9916	-
October	7741	7823	7017	-	8655	8319	8201	-	5951	6274	6094	-
November	4174	5072	3607	-	4173	4267	6546	-	3018	3739	2912	-
December	4546	6524	2778	-	4309	3130	3437	-	3483	2622	3575	-
Annual Total	118383	124190	124563	65053	118028	99233	115979	59417	103841	102144	106995	22119

Figure 1.1: SWEEP Organizational Structure


Federal-Provincial Management Committee (AC, OMAF, EC, MOE)
Technology Assessment Panel (Federal-Provincial -University-Private Sector)
Land Use Monitoring Committee (Working Group on Measurement of Land Management and Cropping Practices)
Federal-Provincial Working Committee (AC, OMAF, EC, MOE, MNR)
Conservation Information Center (Federal-Provincial University -Private Sector)
Administration Monitoring and Public Information Sub-Program (AC, OMAF)
Local Demonstration Sub-Program (OMAF)
Technology Evaluation and Development Sub-Program (AC)
Farm Level Economic Analysis (AC)
Technical Assistance Sub-Program (OMAF)
Pilot Demonstration Watershed Sub-Program (AC)
Water Quality Monitoring (MOE)
Soil and Water Conservation Incentives Grants Sub-Program (OMAF)
Socio-Economic Analysis (AC)
Water Quantity Monitoring (EC)

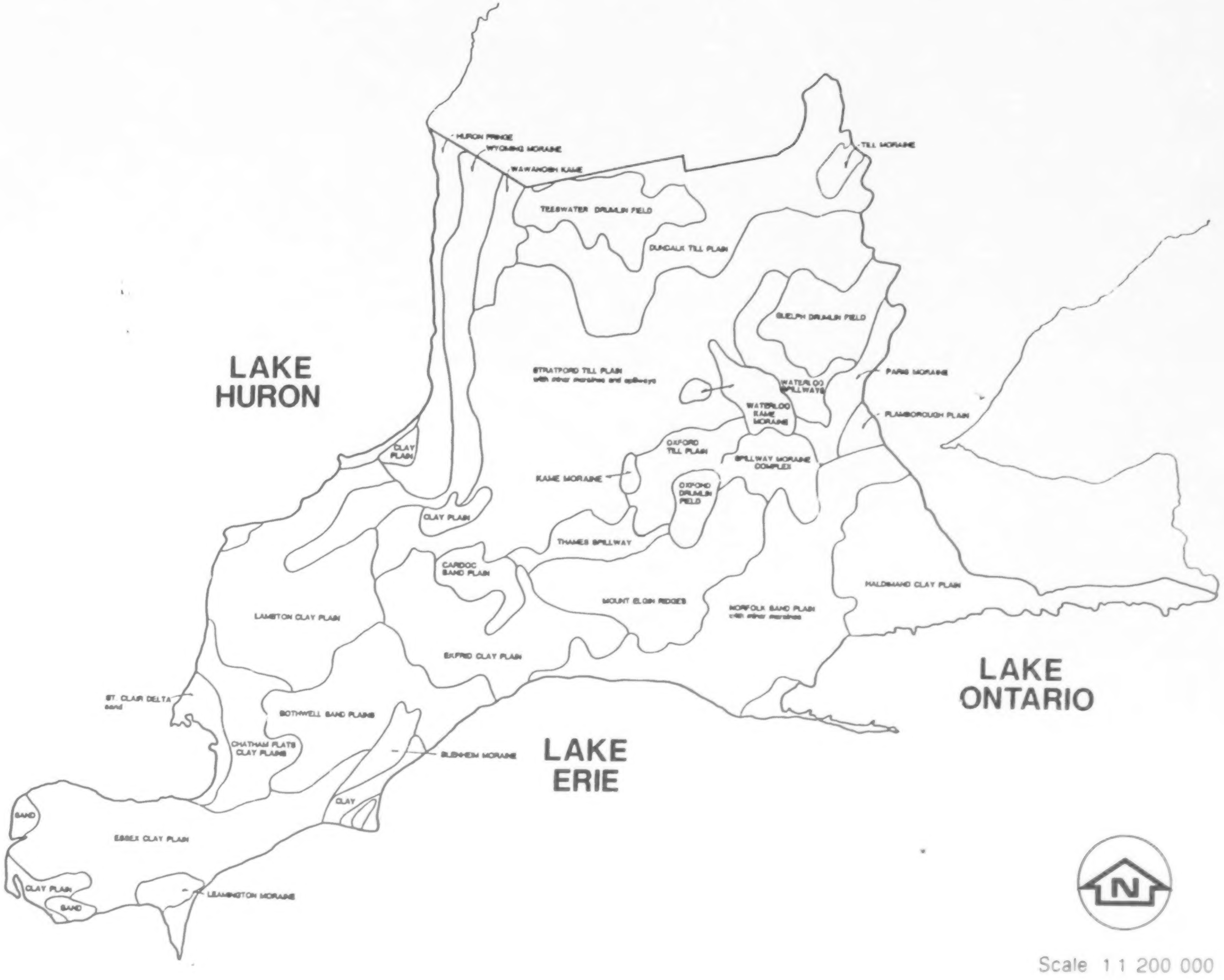
Abbreviations
AC Agriculture Canada
EC Environment Canada
MNR Ontario Ministry of Natural Resources
MOE Ontario Ministry of the Environment
OMAF Ontario Ministry of Agriculture and Food



Legend
Ⓚ Kettle Creek
Ⓟ Pittock
Ⓔ Essex
◌ Lake Erie Drainage Basin
Georgian Bay
Lake Huron
Lake Ontario
Lake Erie
Toronto
Hamilton
Woodstock
London
Windsor
Test
Control
Test
Control
Test
Control
50 20 0 50 100 km

Sweep PWS Watersheds in Southern Ontario

beak	beak consultants limited	Figure 1.2	March 1994 Rev. 00


HURON FRINGE
WYOMING MORAINE
WAWANOSH KAME
TILL MORAINE
TEESWATER DRUMLIN FIELD
DUNDALK TILL PLAIN
GUELPH DRUMLIN FIELD
LAKE HURON
STRATFORD TILL PLAIN with minor moraines and spillways
WATERLOO SPILLWAYS
PARIS MORAINE
WATERLOO KAME MORAINE
FLAMBOROUGH PLAIN
CLAY PLAIN
OXFORD TILL PLAIN
SPILLWAY MORAINE COMPLEX
KAME MORAINE
OXFORD DRUMLIN FIELD
CLAY PLAIN
THAMES SPILLWAY
CARADOC SAND PLAIN
HALDIMAND CLAY PLAIN
MOUNT ELGIN RIDGES
NORFOLK SAND PLAIN with minor moraines
LAMBTON CLAY PLAIN
EKFRID CLAY PLAIN
LAKE ONTARIO
ST. CLAIR DELTA sand
BOTHWELL SAND PLAINS
CHATHAM FLATS CLAY PLAINS
BLENHEIM MORAINE
LAKE ERIE
CLAY
SAND
ESSEX CLAY PLAIN
CLAY PLAIN
SAND
LEAMINGTON MORAINE
N
Scale 1:1 200 000

SWEEP

PILOT WATERSHED PROJECT

Canada

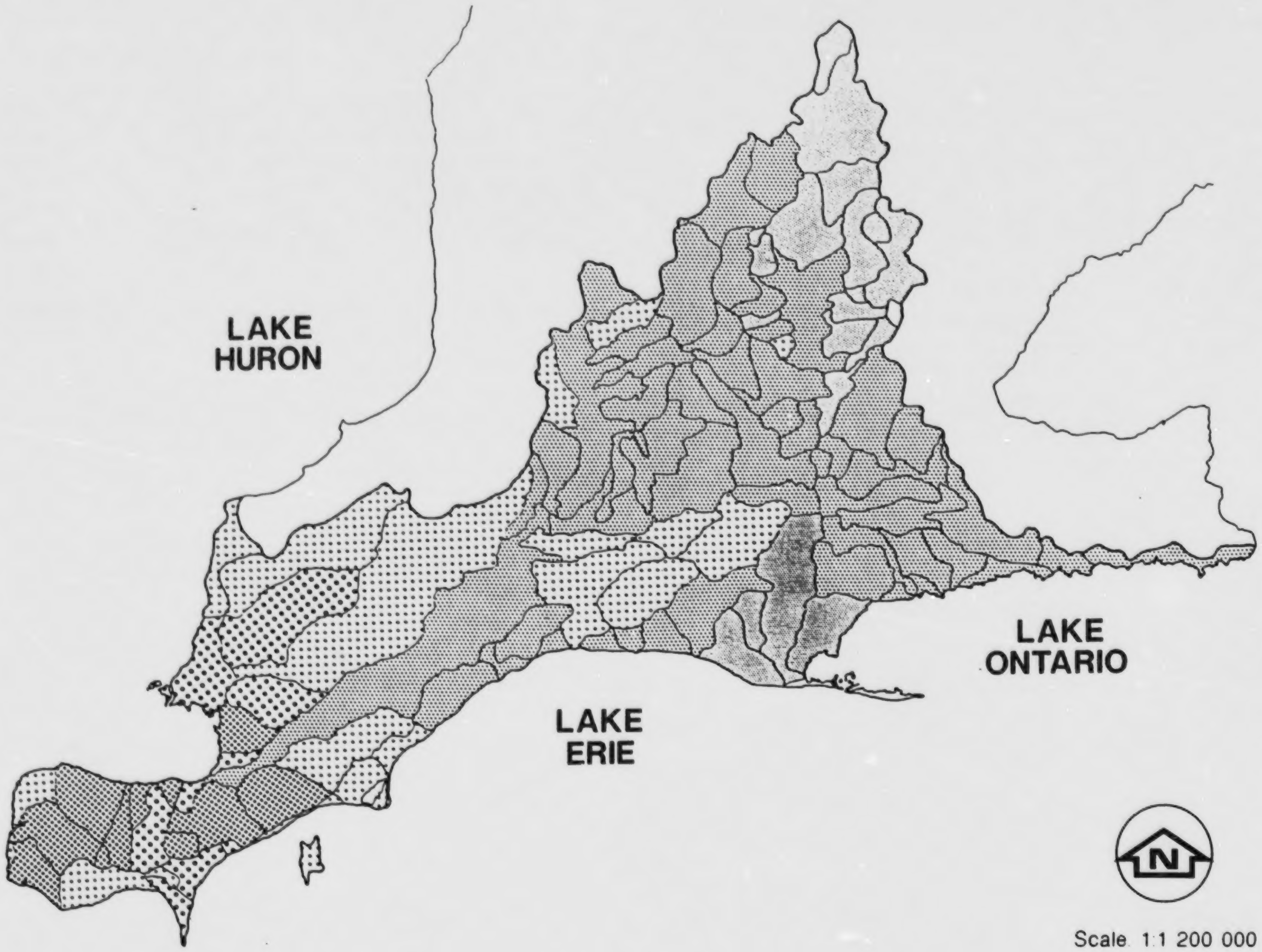
Ontario

CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

PHYSIOGRAPHIC FEATURES

2.1


LAKE HURON
LAKE ERIE
LAKE ONTARIO
N
Scale 1:1 200 000

SWEEP

PILOT WATERSHED PROJECT

Canada ⊛ Ontario

Legend

Phosphorus kg / ha / yr

□	< .20
░	.20 – .50
▒	.51 – .80
⁘	.81 – 1.1
⁙	1.11 – 1.4
▓	> 1.4

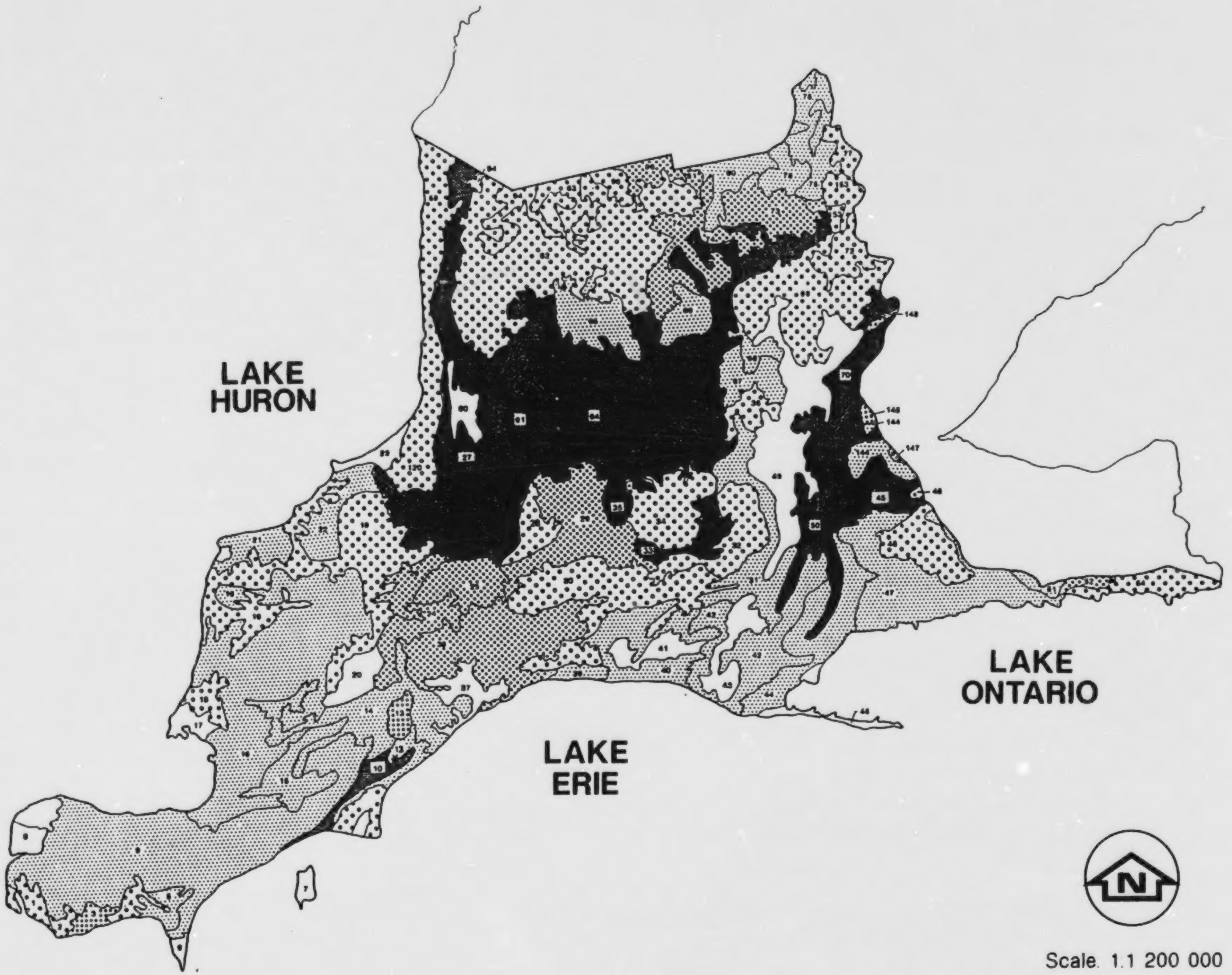
source : Miller and Spires 1978

CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

PHOSPHORUS LOADINGS

2.2



Scale. 1:1 200 000

SWEEP

PILOT WATERSHED PROJECT

Canada | Ontario

Legend

ESTIMATED EROSION RATES		T / ha / yr
☐	LOW	0 – 2.5
░	MODERATELY – LOW	2.5 – 5
▒	MODERATE	5 – 10
⁘	MODERATELY – HIGH	10 – 20
■	HIGH	> 20

source : Ontario Institute of Pedology 1984

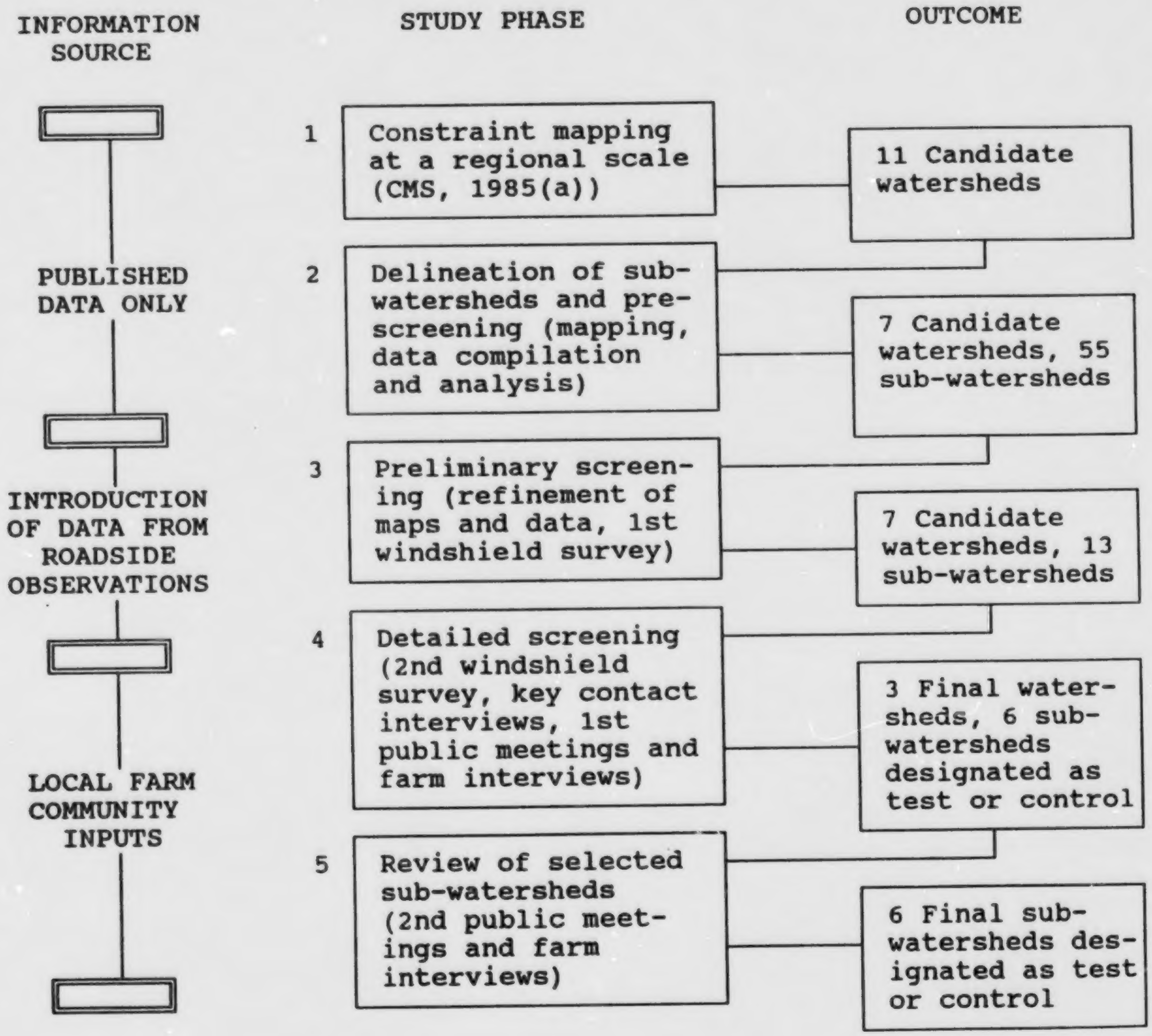
CMS conservation management systems

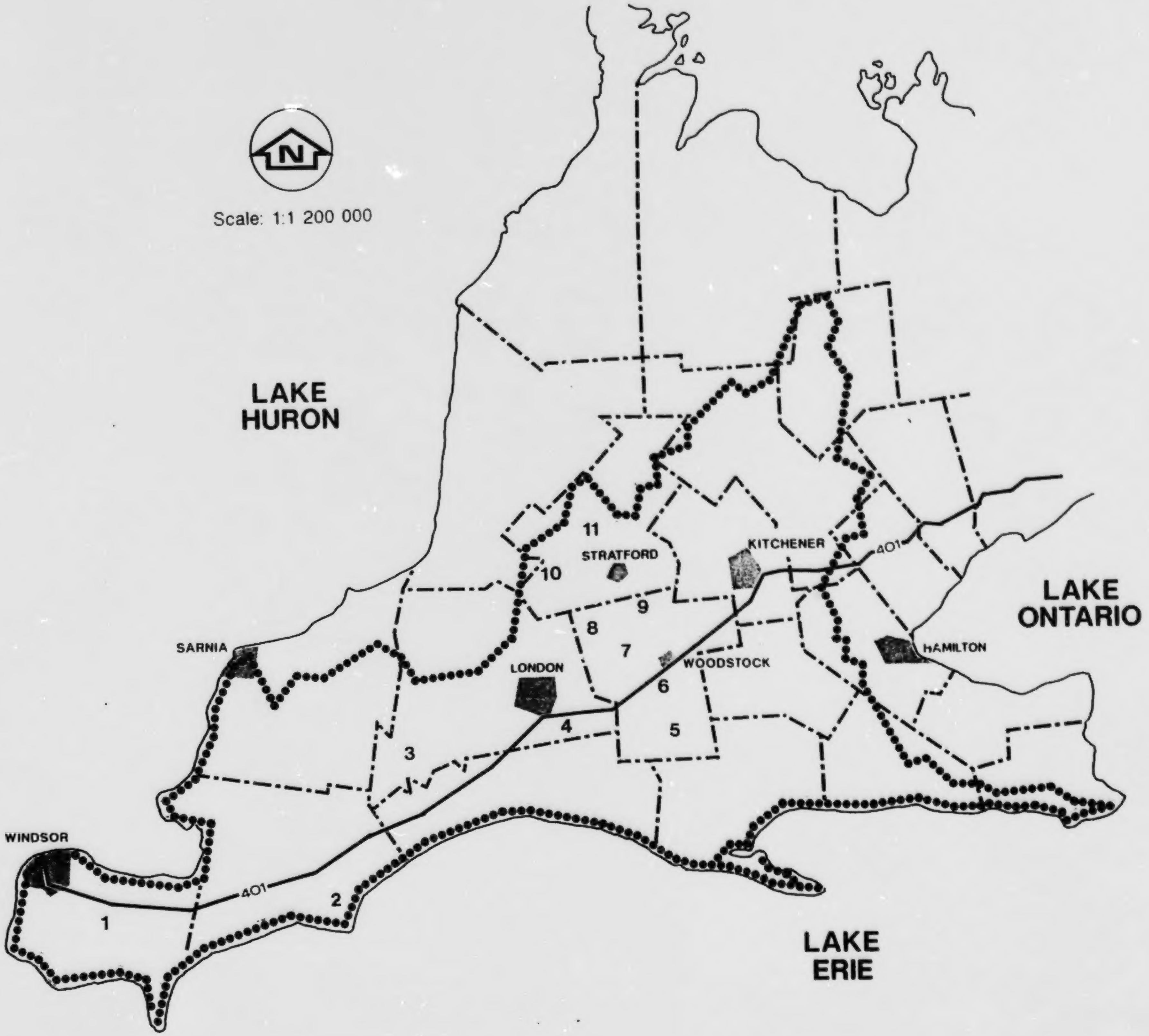
CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

EROSION RATES

FIGURE 2.4:

APPROACH TO THE SELECTION OF PILOT SUB-WATERSHEDS


INFORMATION SOURCE
STUDY PHASE
OUTCOME
1
Constraint mapping at a regional scale (CMS, 1985(a))
11 Candidate watersheds
PUBLISHED DATA ONLY
2
Delineation of sub-watersheds and pre-screening (mapping, data compilation and analysis)
7 Candidate watersheds, 55 sub-watersheds
3
Preliminary screening (refinement of maps and data, 1st windshield survey)
INTRODUCTION OF DATA FROM ROADSIDE OBSERVATIONS
7 Candidate watersheds, 13 sub-watersheds
4
Detailed screening (2nd windshield survey, key contact interviews, 1st public meetings and farm interviews)
3 Final watersheds, 6 sub-watersheds designated as test or control
LOCAL FARM COMMUNITY INPUTS
5
Review of selected sub-watersheds (2nd public meetings and farm interviews)
6 Final sub-watersheds designated as test or control


N
Scale: 1:1 200 000
LAKE HURON
LAKE ONTARIO
LAKE ERIE
SARNIA
WINDSOR
LONDON
STRATFORD
KITCHENER
WOODSTOCK
HAMILTON
401
401
1
2
3
4
5
6
7
8
9
10
11

SWEEP

PILOT WATERSHED PROJECT

Canada

Ontario

Legend

●●●●●● LAKE ERIE WATERSHED

-·-·- COUNTY BOUNDARY

CANDIDATE AREAS

1 - ESSEX AREA
2 - RONDEAU BAY
3 - NEWBIGGEN CREEK
4 - KETTLE CREEK
5 - SPITTLER CREEK
6 - BEACHVILLE AREA
7 - HOLIDAY CREEK
8 - KINTORE CREEK
9 - PITTOCK RESERVOIR BASIN
10 - FISH CREEK
11 - WHIRL CREEK

CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

KEY MAP

Figure 3.1

ESSEX SUB-WATERSHEDS

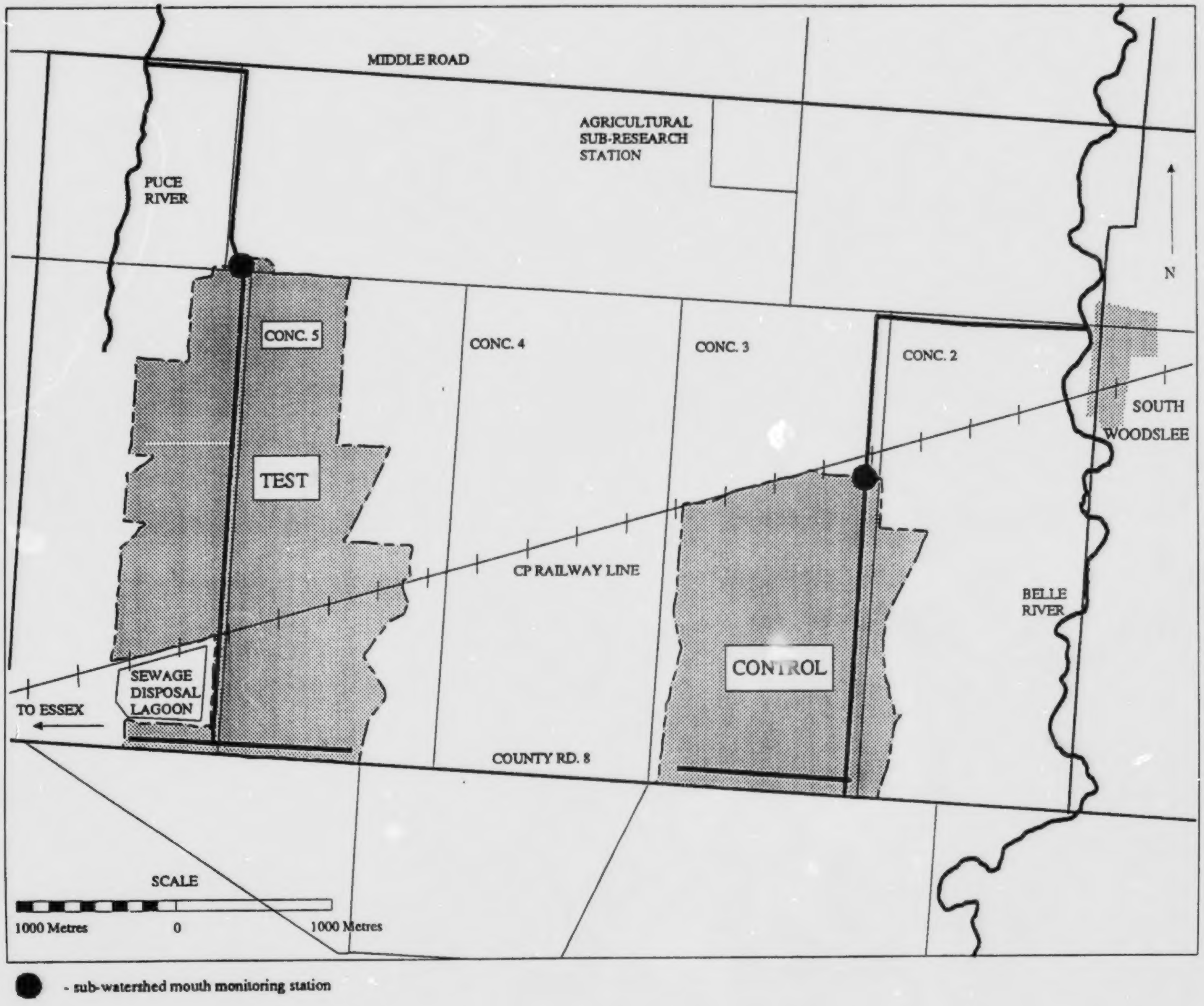

MIDDLE ROAD
AGRICULTURAL SUB-RESEARCH STATION
PUCE RIVER
N
CONC. 5
CONC. 4
CONC. 3
CONC. 2
SOUTH WOODSLEE
TEST
CP RAILWAY LINE
BELLE RIVER
SEWAGE DISPOSAL LAGOON
CONTROL
TO ESSEX
COUNTY RD. 8
SCALE
1000 Metres
0
1000 Metres
● - sub-watershed mouth monitoring station

FIGURE 3.2

HYDROLOGICAL RESPONSE - ESSEX SUBWATERSHEDS

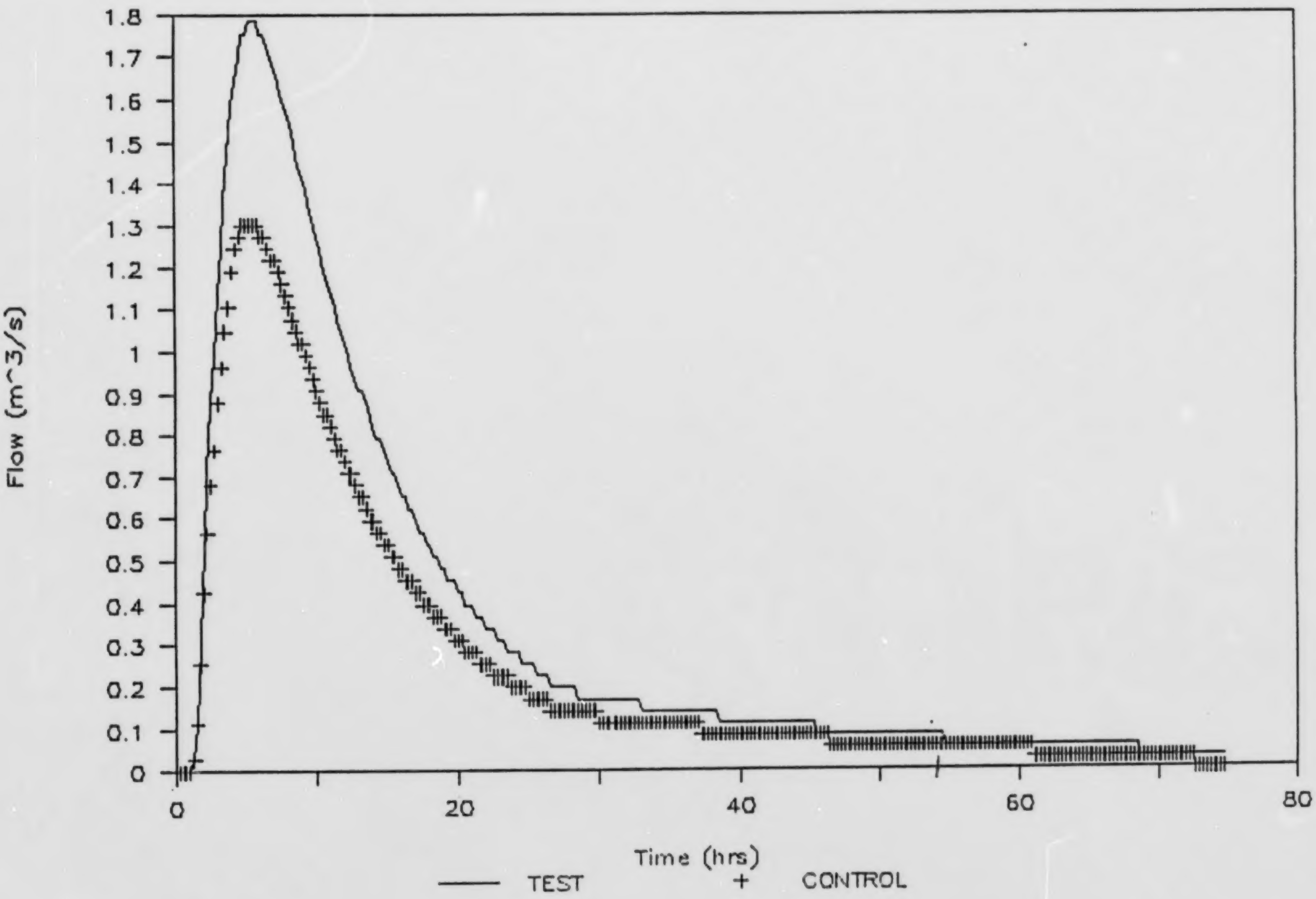


FIGURE 3.3

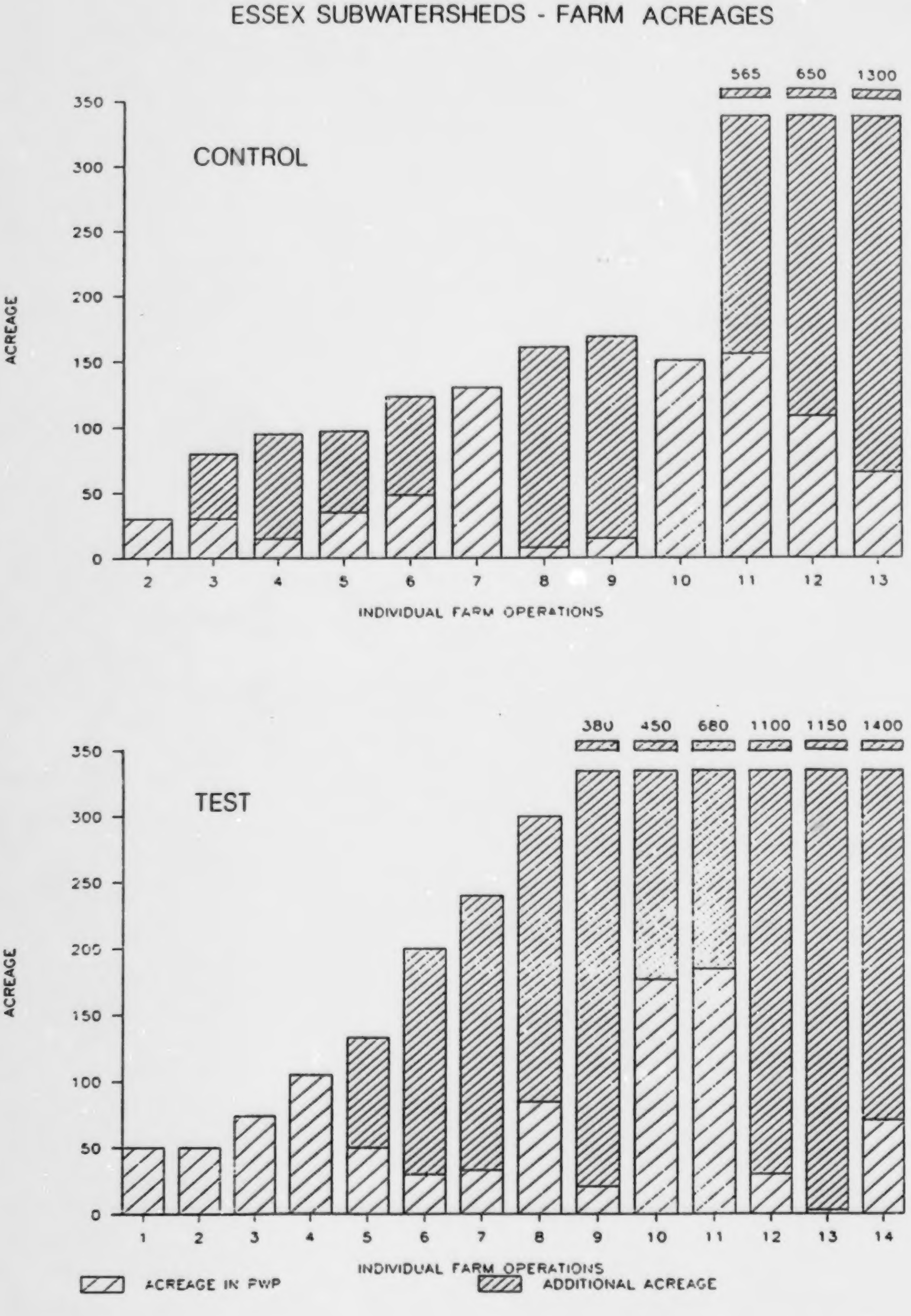

ESSEX SUBWATERSHEDS - FARM ACREAGES
CONTROL
ACREAGE
0
50
100
150
200
250
300
350
565
650
1300
2
3
4
5
6
7
8
9
10
11
12
13
INDIVIDUAL FARM OPERATIONS
TEST
ACREAGE
0
50
100
150
200
250
300
350
380
450
680
1100
1150
1400
1
2
3
4
5
6
7
8
9
10
11
12
13
14
INDIVIDUAL FARM OPERATIONS
ACREAGE IN PWP
ADDITIONAL ACREAGE

FIGURE 3.4

ESSEX WATERSHEDS - ENTERPRISE ACREAGES

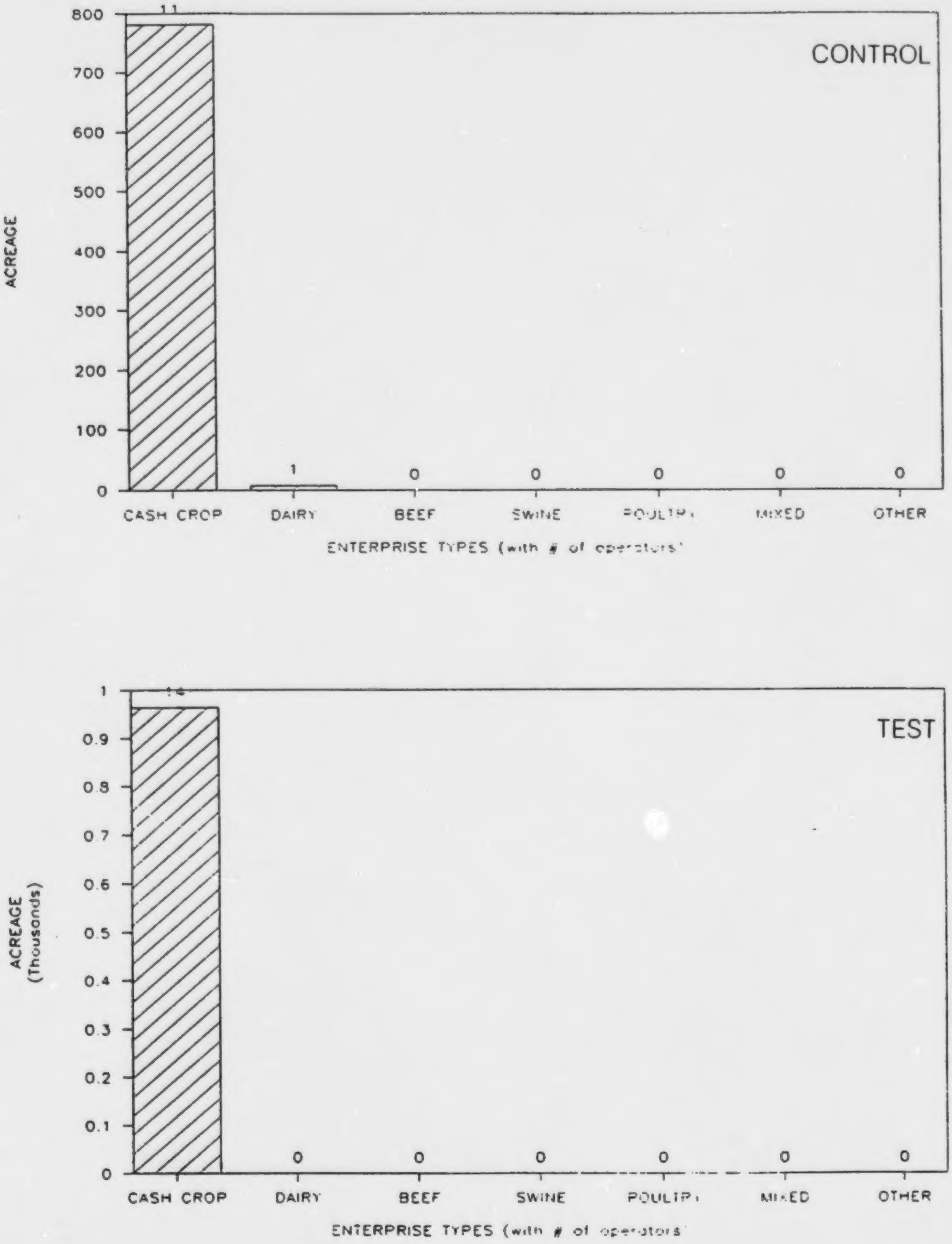
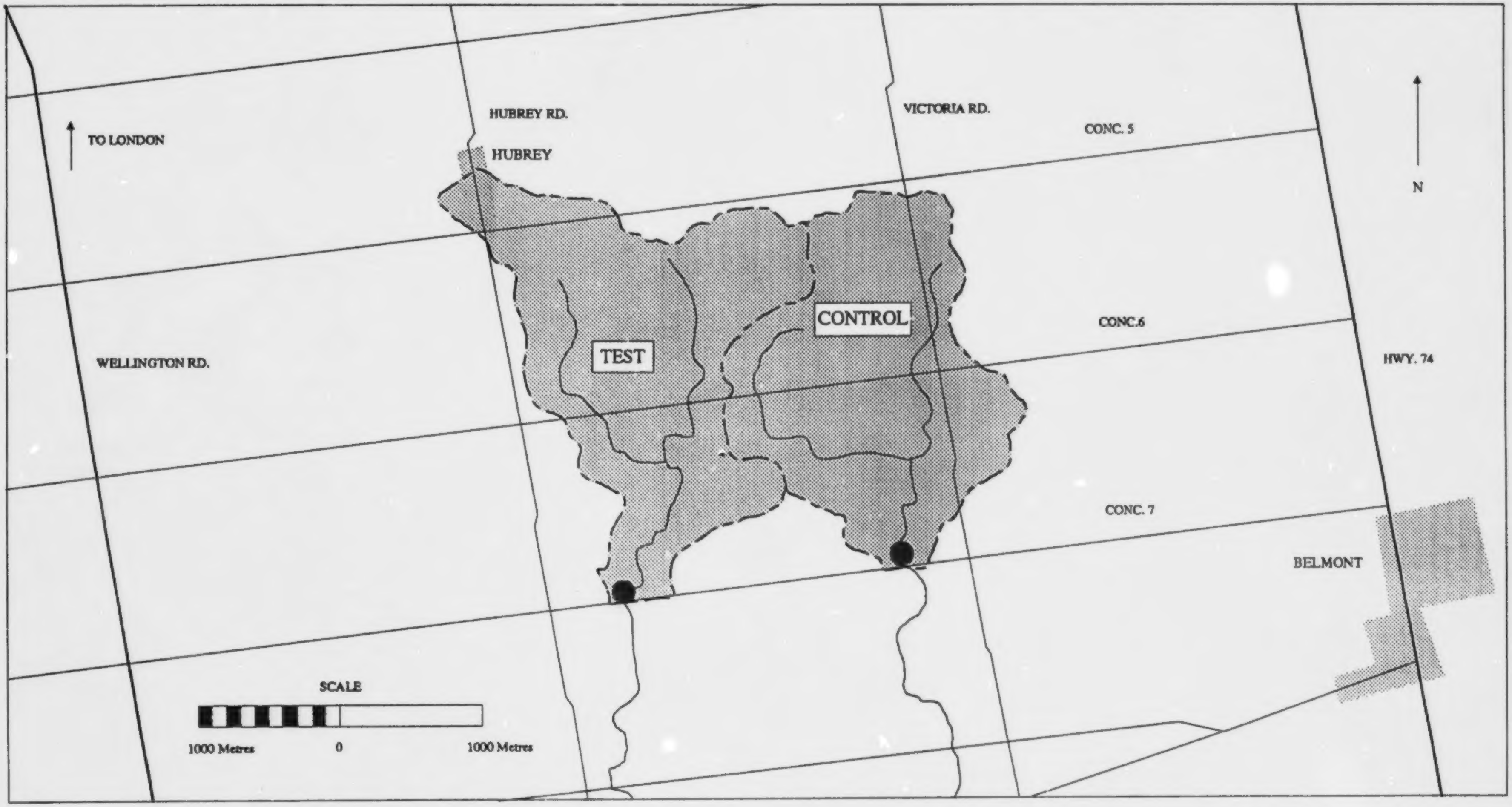


FIGURE 3.5: KETTLE CREEK SUB-WATERSHEDS


HUBREY RD.
VICTORIA RD.
CONC. 5
TO LONDON
HUBREY
N
CONTROL
CONC.6
TEST
WELLINGTON RD.
HWY. 74
CONC. 7
BELMONT
SCALE
1000 Metres
0
1000 Metres

● -sub-watershed mouth monitoring station

FIGURE 3.6

HYDROLOGICAL RESPONSE - KETTLE SUBWATERSHEDS

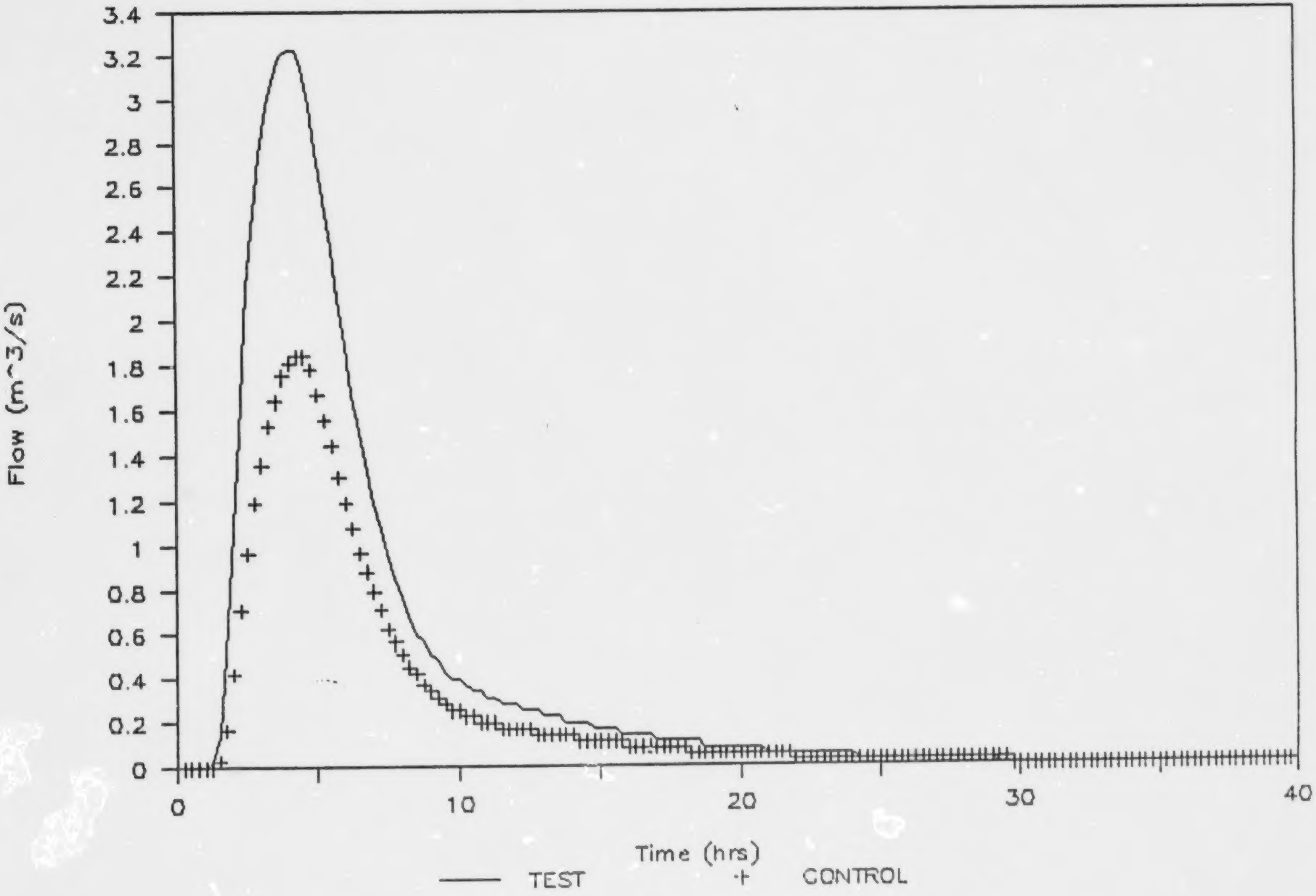


FIGURE 3.7

KETTLE SUBWATERSHEDS - FARM ACREAGES

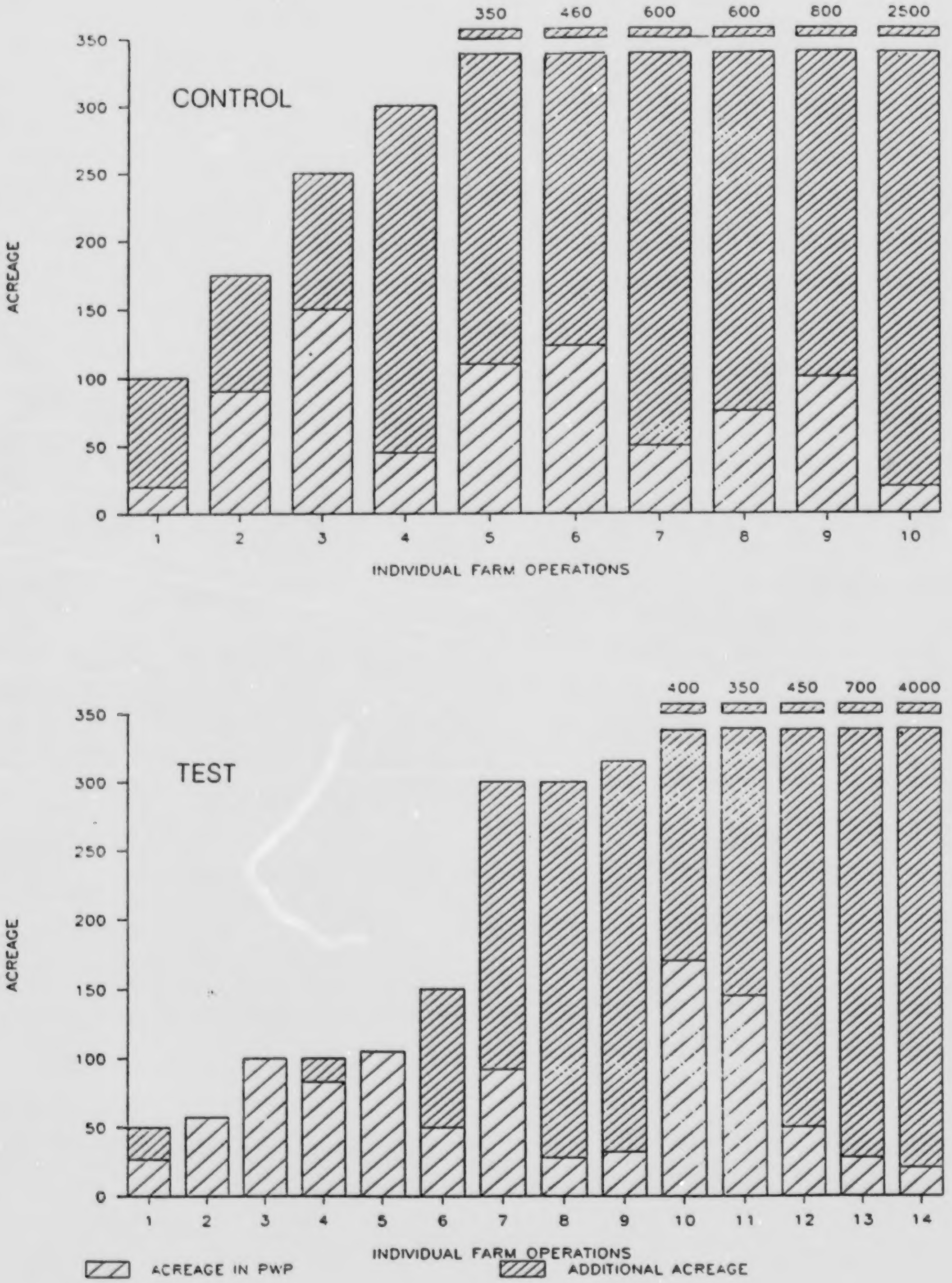


FIGURE 3.8

KETTLE SUBWATERSHEDS - ENTERPRISE ACREAGES

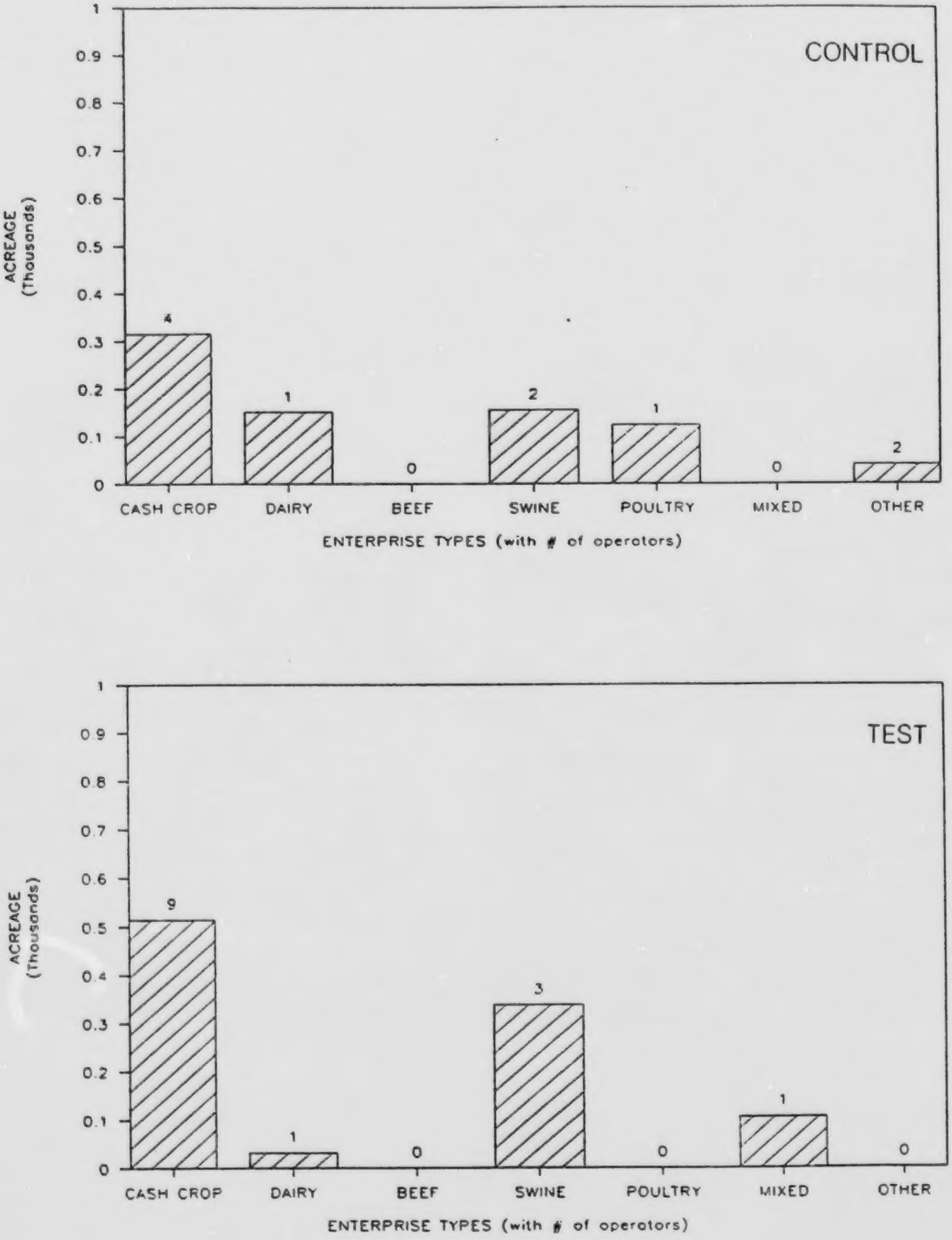
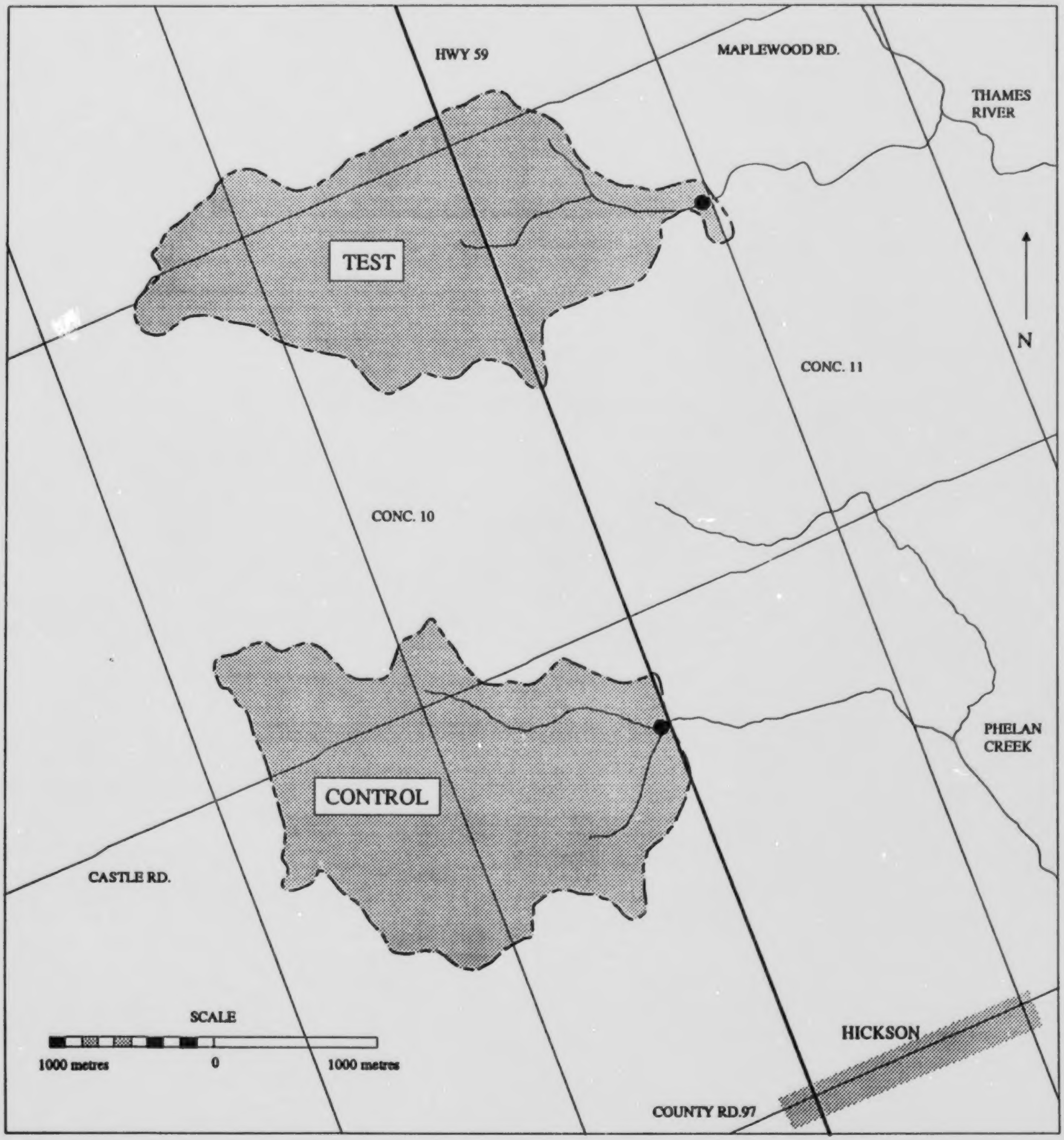


FIGURE 3.9

PITTOCK SUB-WATERSHEDS


HWY 59
MAPLEWOOD RD.
THAMES RIVER
TEST
N
CONC. 11
CONC. 10
PHELAN CREEK
CONTROL
CASTLE RD.
SCALE
1000 metres
0
1000 metres
HICKSON
COUNTY RD.97

● - sub-watershed mouth monitoring station

FIGURE 3.10

HYDROLOGICAL RESPONSE - PITTOCK SUBWATERSHEDS

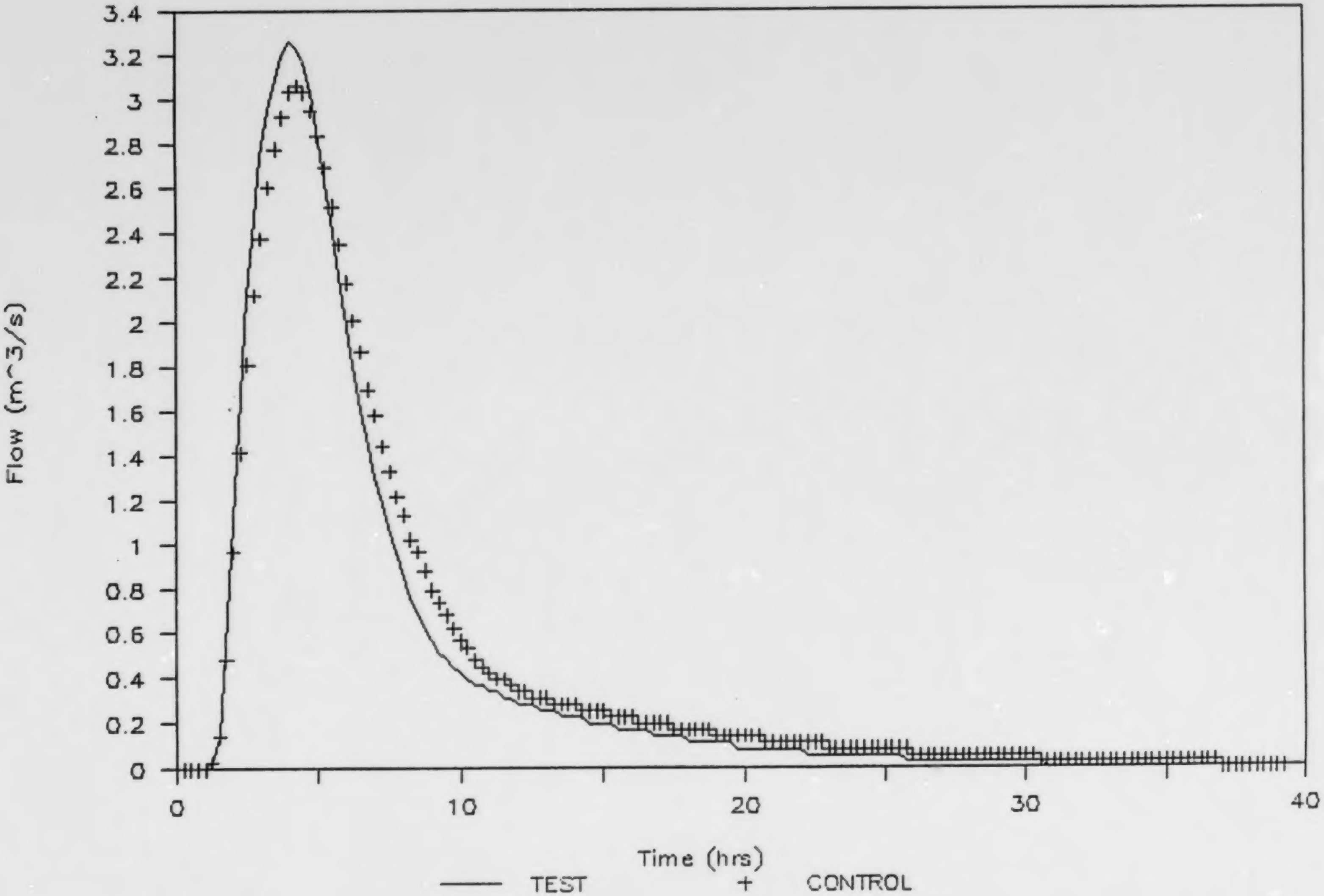


FIGURE 3.11

PITTOCK SUBWATERSHEDS - FARM ACREAGES

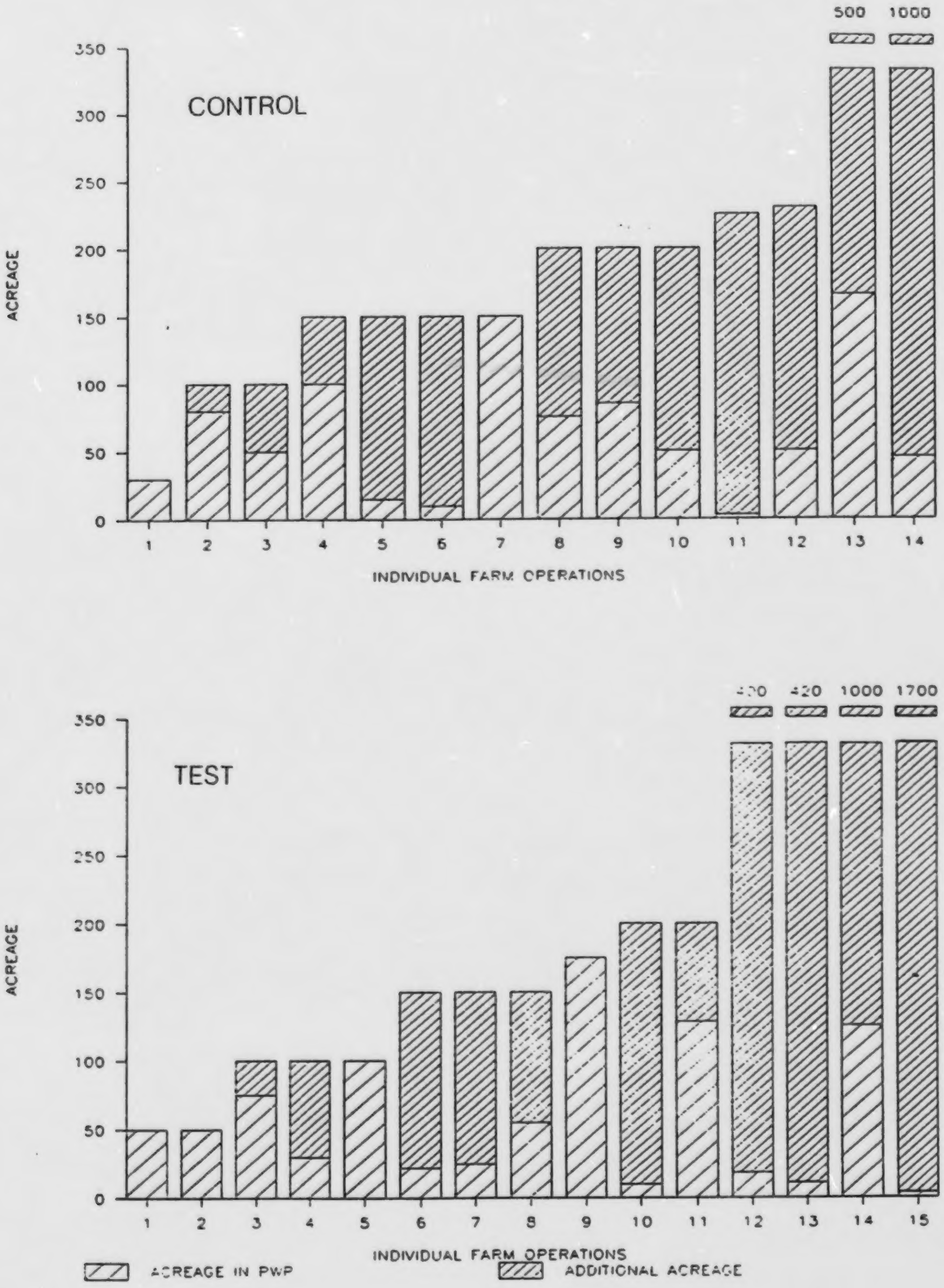


FIGURE 3.12

PITTOCK SUBWATERSHEDS - ENTERPRISE ACREAGES

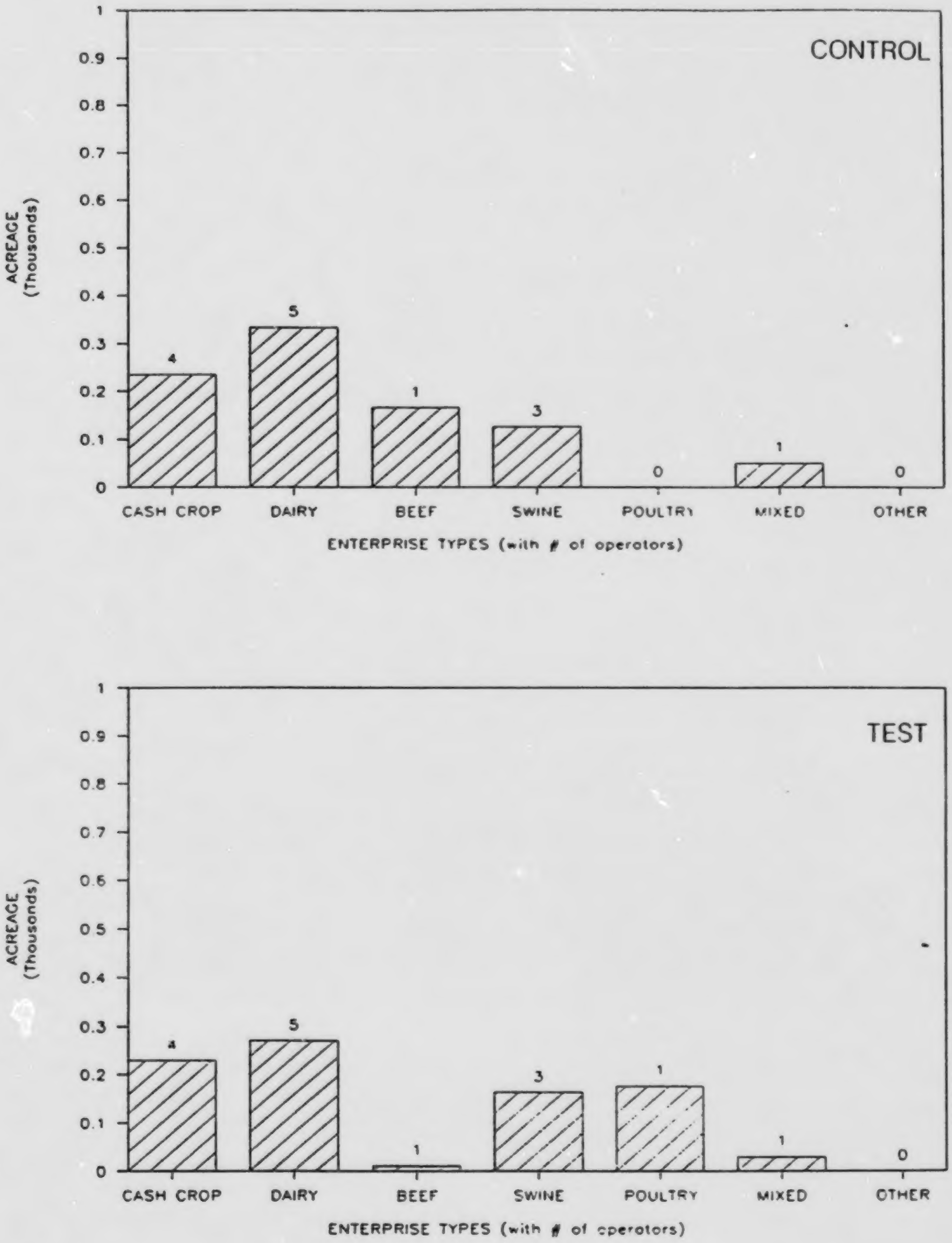


FIGURE 3.13

ESSEX SUB-WATERSHEDS
Microbasin Sites

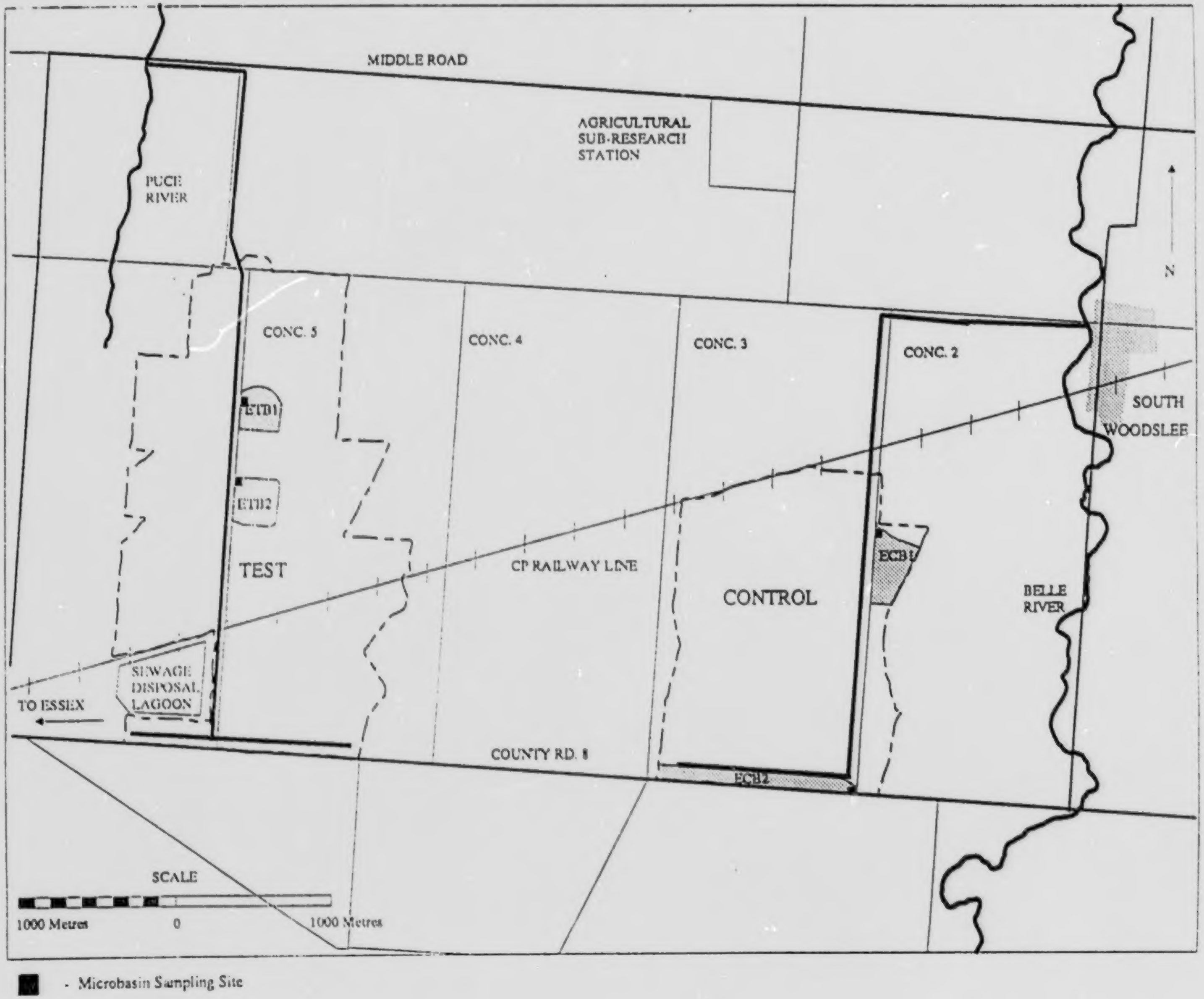

MIDDLE ROAD
AGRICULTURAL SUB-RESEARCH STATION
PUCE RIVER
N
CONC. 5
CONC. 4
CONC. 3
CONC. 2
SOUTH WOODSLEE
ETB1
ETB2
TEST
CP RAILWAY LINE
CONTROL
ECB1
BELLE RIVER
SEWAGE DISPOSAL LAGOON
TO ESSEX
COUNTY RD. 8
ECB2
SCALE
1000 Metres
0
1000 Metres
■ - Microbasin Sampling Site

FIGURE 3.14

KETTLE CREEK SUB-WATERSHEDS
Microbasin Sites

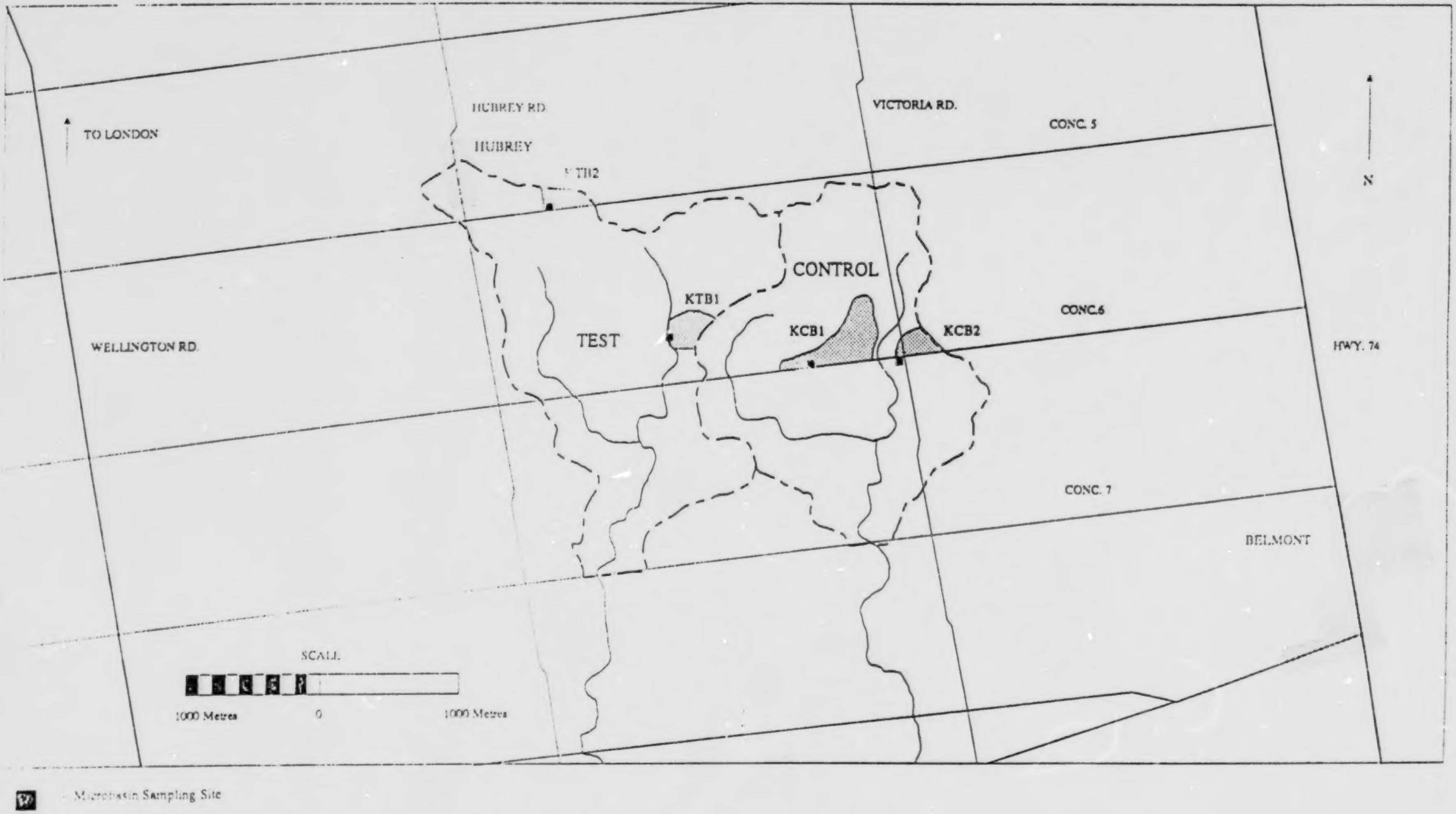
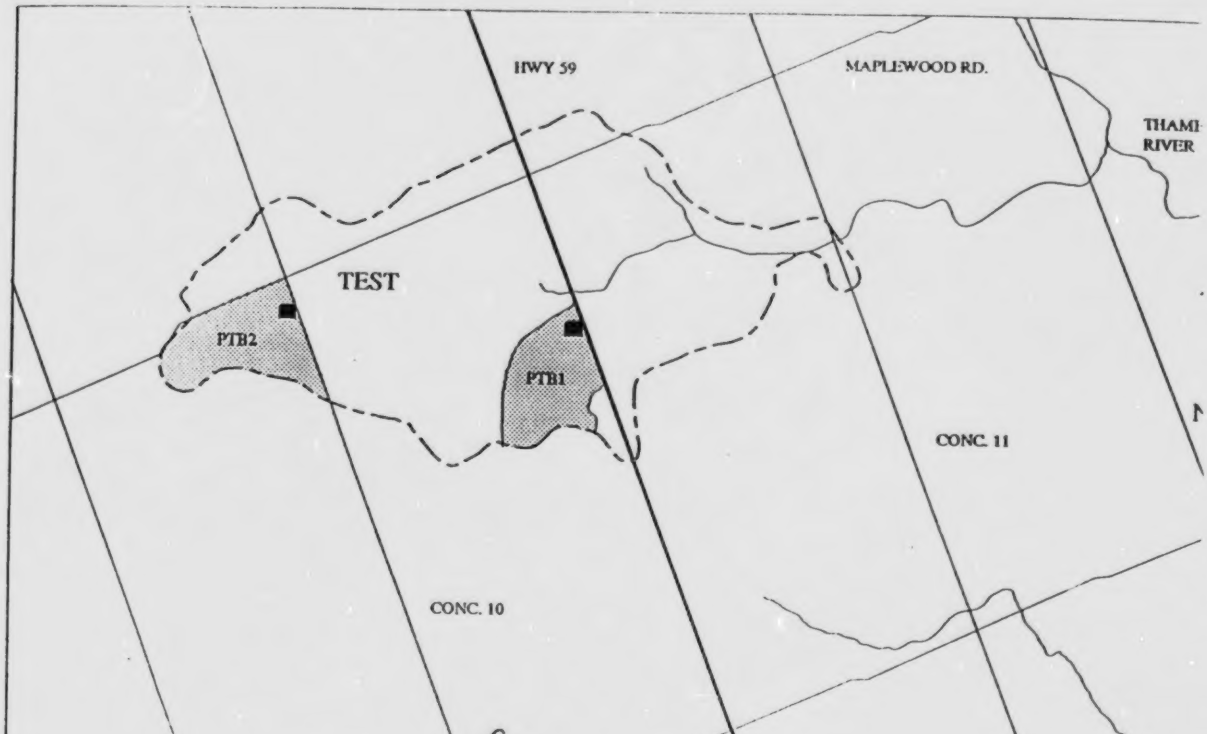

HUBREY RD
TO LONDON
HUBREY
KTB2
VICTORIA RD.
CONC. 5
N
CONTROL
KTB1
TEST
KCB1
KCB2
CONC.6
WELLINGTON RD.
HWY. 74
CONC. 7
BELMONT
SCALE
1000 Metres
0
1000 Metres
▨ - Microbasin Sampling Site

FIGURE 3.15

PITTOCK SUB-WATERSHEDS
Microbasin Sites


HWY 59
MAPLEWOOD RD.
THAMI
RIVER
TEST
PTB2
PTB1
CONC. 11
CONC. 10
PCB1
CONTROL
PCB2
CASTLE RD
PHELA
CREEK
SCALE
1000 metres
0
1000 metres
HICKSON
COUNTY RD.97

■ - Microbasin Sampling Sites

Figure 4.1: ESSEX SUB-WATERSHEDS

Meteorological Sites

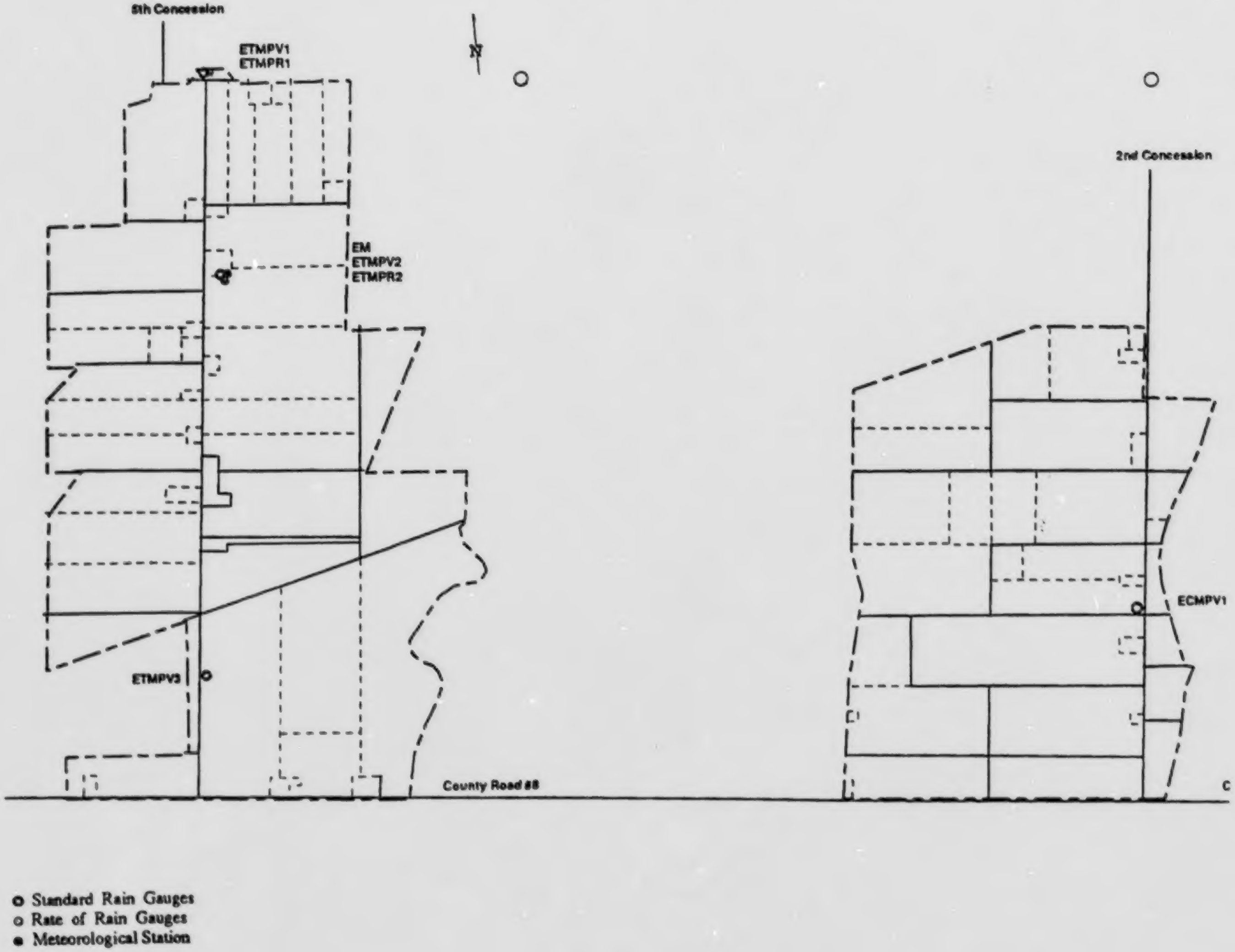

5th Concession
ETMPV1
ETMPR1
N
EM
ETMPV2
ETMPR2
2nd Concession
ECMPV1
ETMPV3
County Road #8
C
o Standard Rain Gauges
o Rate of Rain Gauges
• Meteorological Station

Figure 4.2: KETTLE CREEK SUB-WATERSHEDS

Meteorological Sites

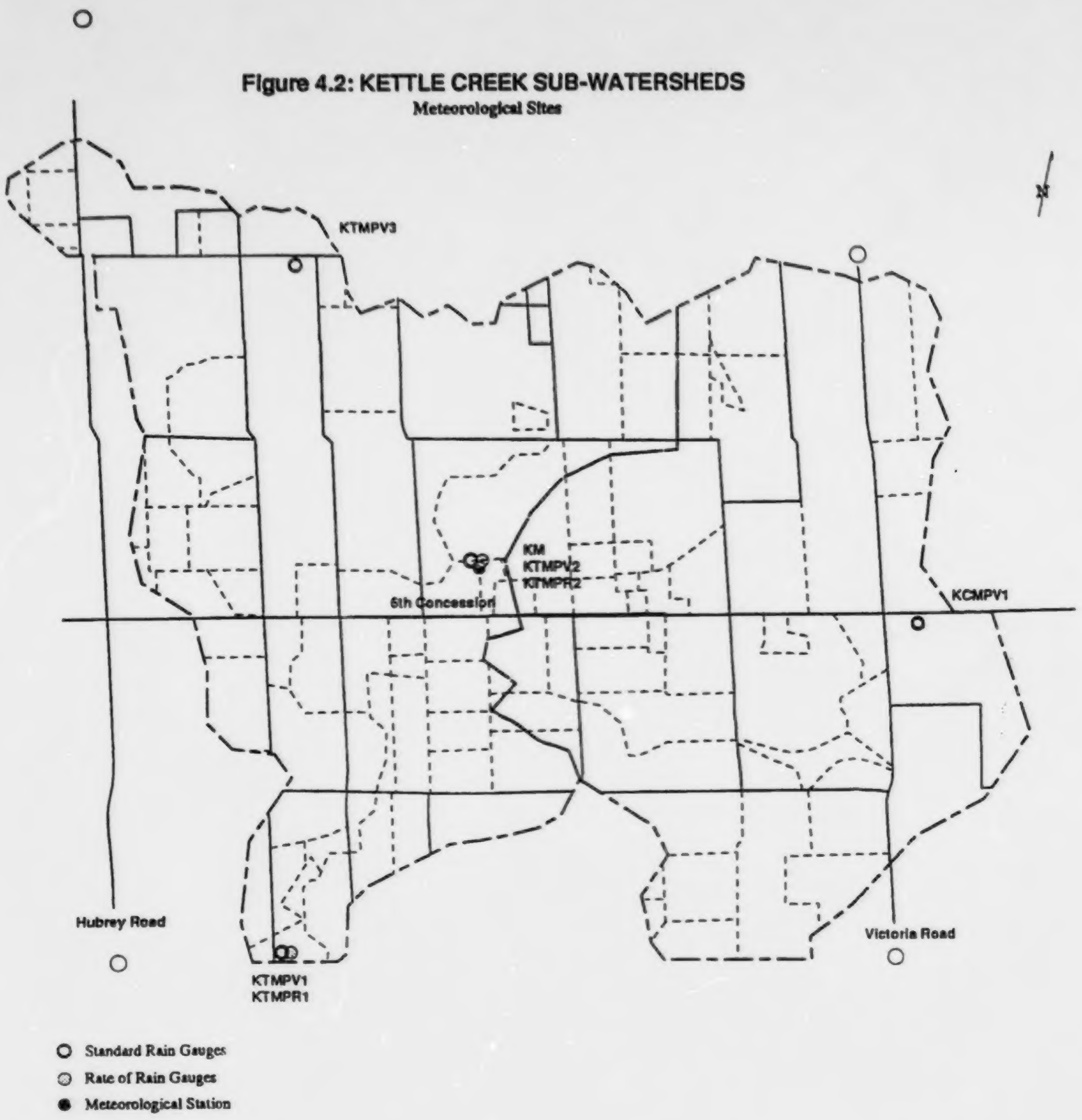

N
KTMPV3
KM
KTMPV2
KTMPR2
6th Concession
KCMPV1
Hubrey Road
KTMPV1
KTMPR1
Victoria Road
○ Standard Rain Gauges
◎ Rate of Rain Gauges
● Meteorological Station

Figure 4.3: PITTOCK SUB-WATERSHEDS

Meteorological Sites

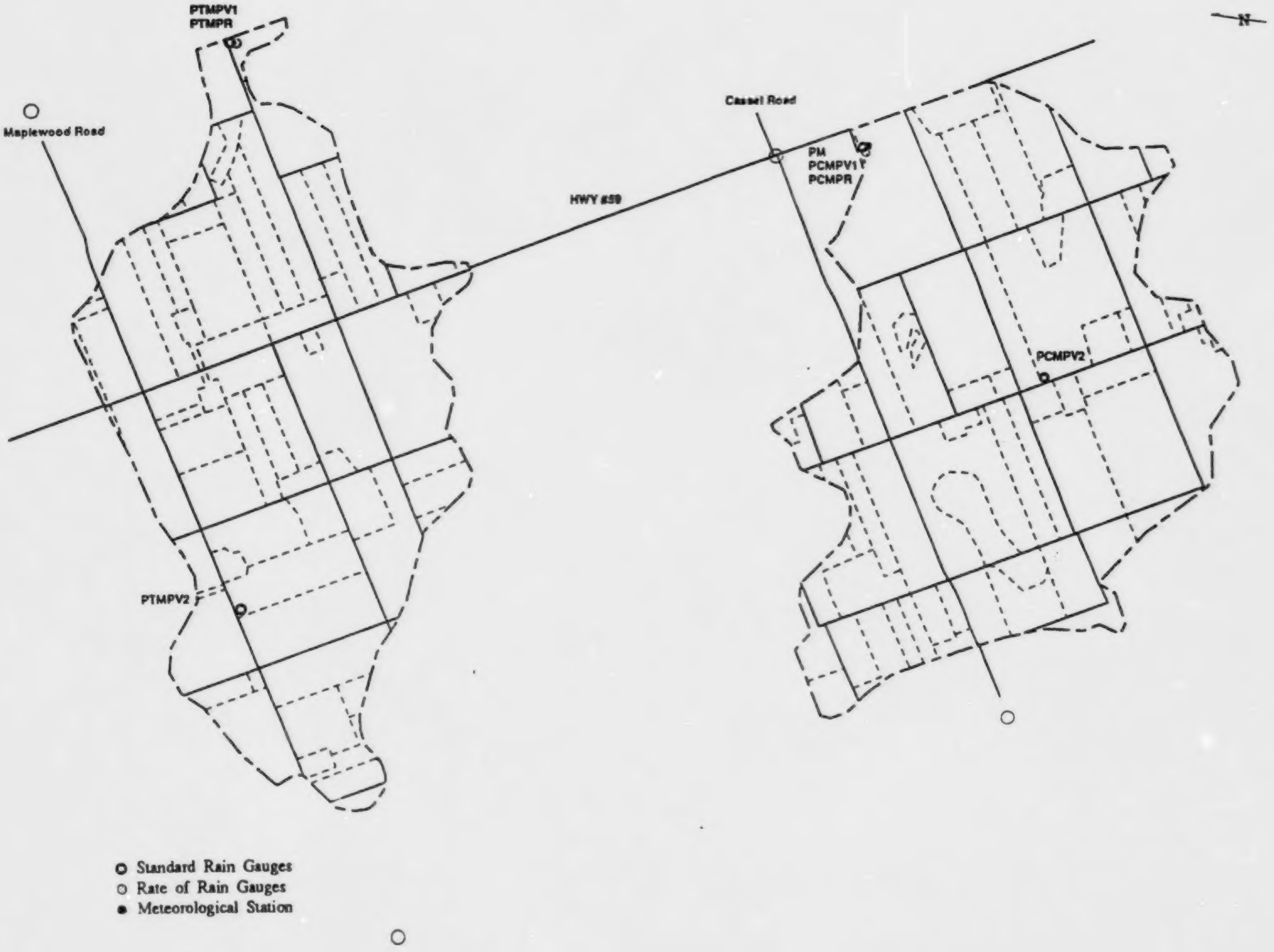

PTMPV1
PTMPR
Maplewood Road
PTMPV2
HWY #59
Cassel Road
PM
PCMPV1
PCMPR
PCMPV2
N
○ Standard Rain Gauges
○ Rate of Rain Gauges
● Meteorological Station

Figure 4.4: Essex Watershed
Monthly Average Air Temperature

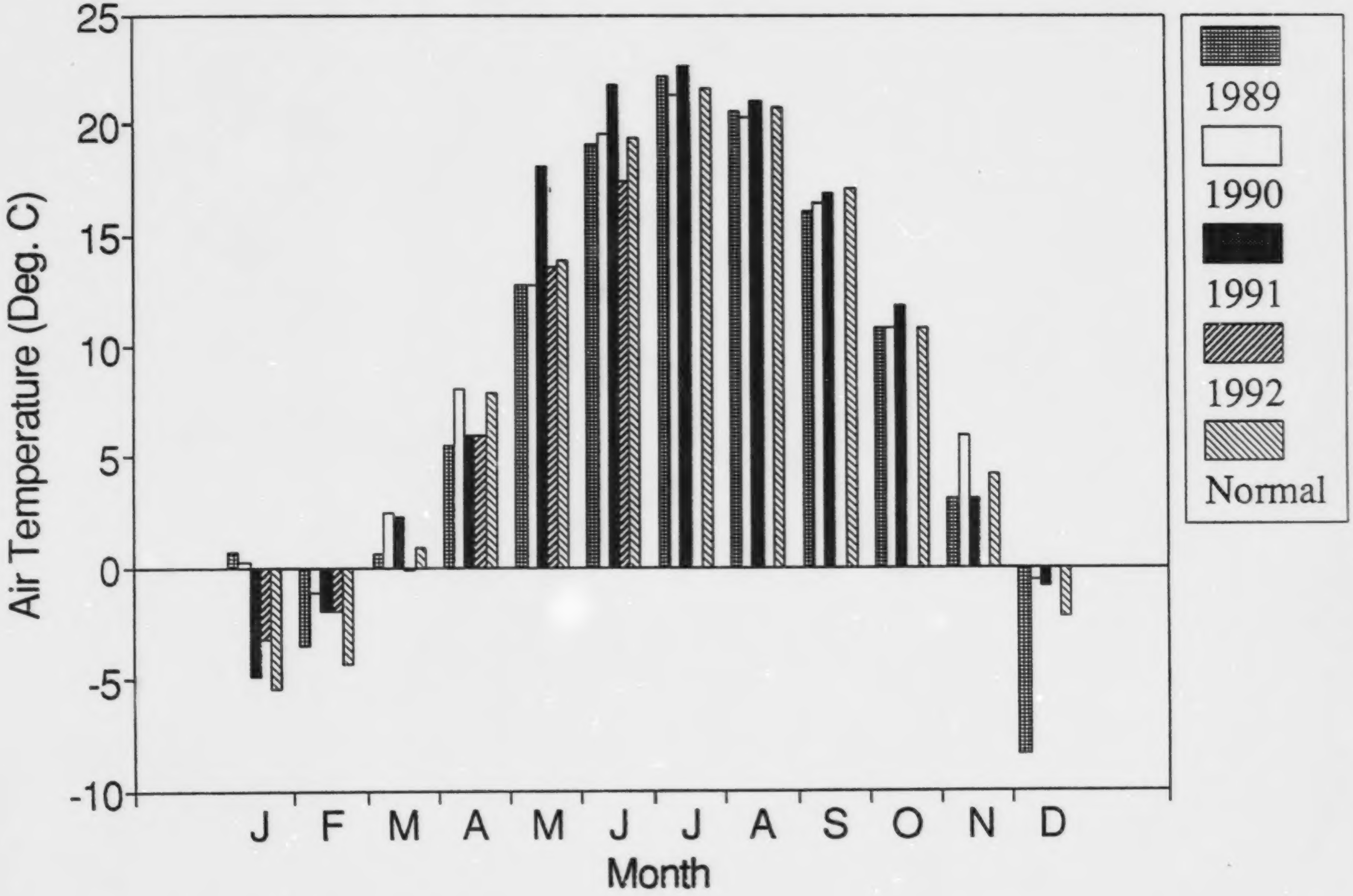


Figure 4.5: Kettle Creek Watershed
Monthly Average Air Temperature

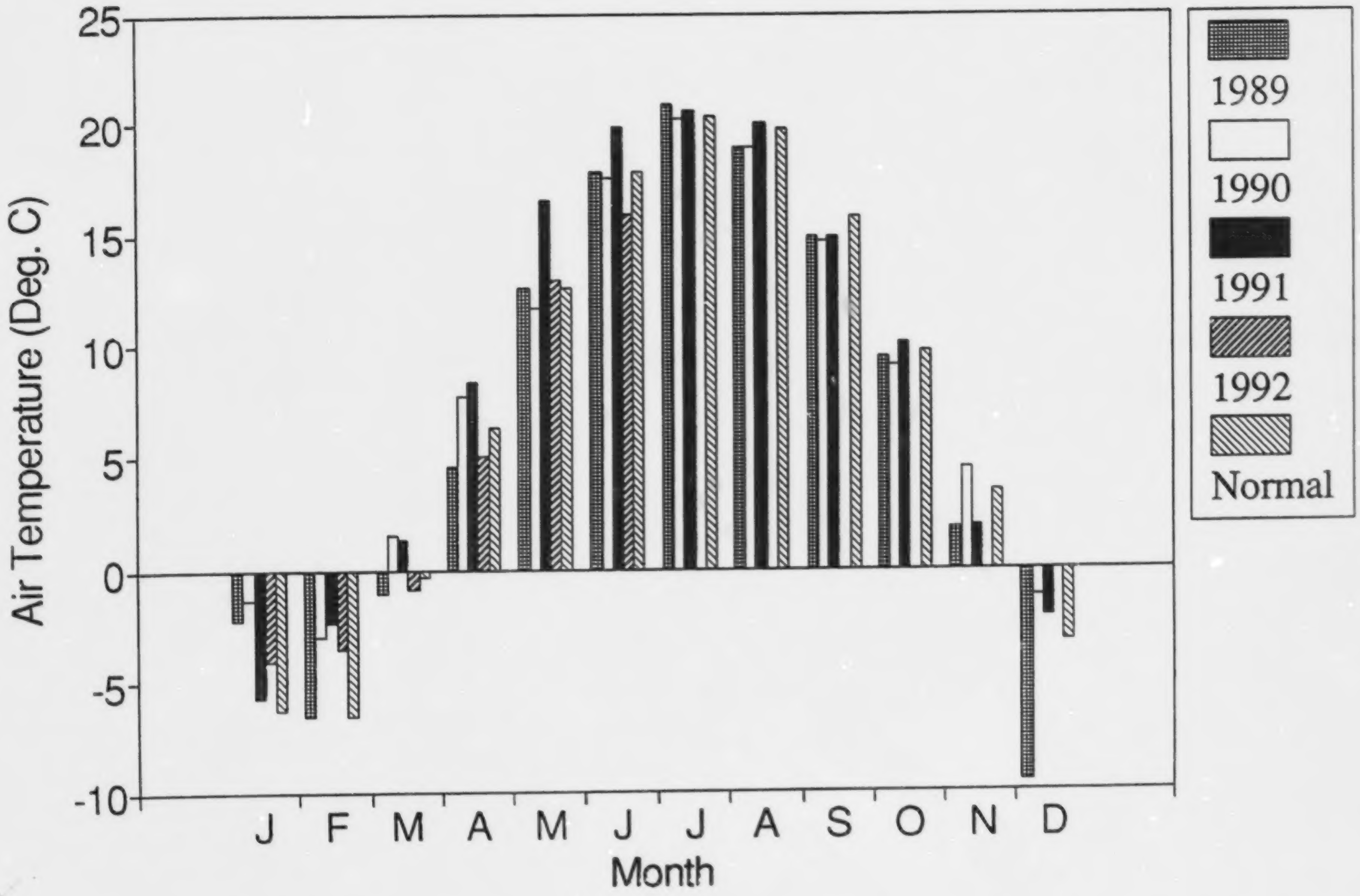


Figure 4.6: Pittock Watershed
Monthly Average Air Temperature

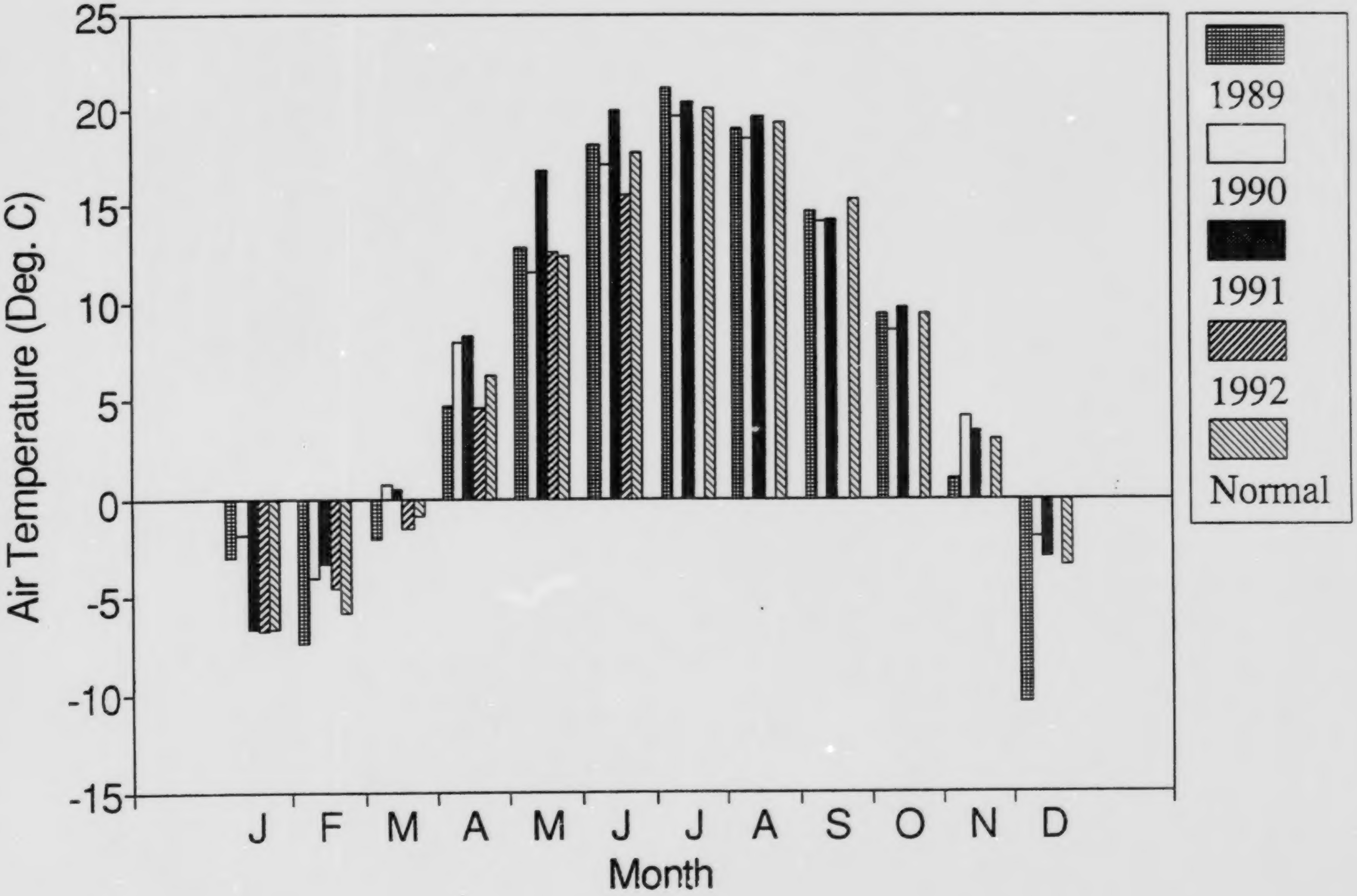


Figure 4.7: Essex Watershed
Monthly Precipitation

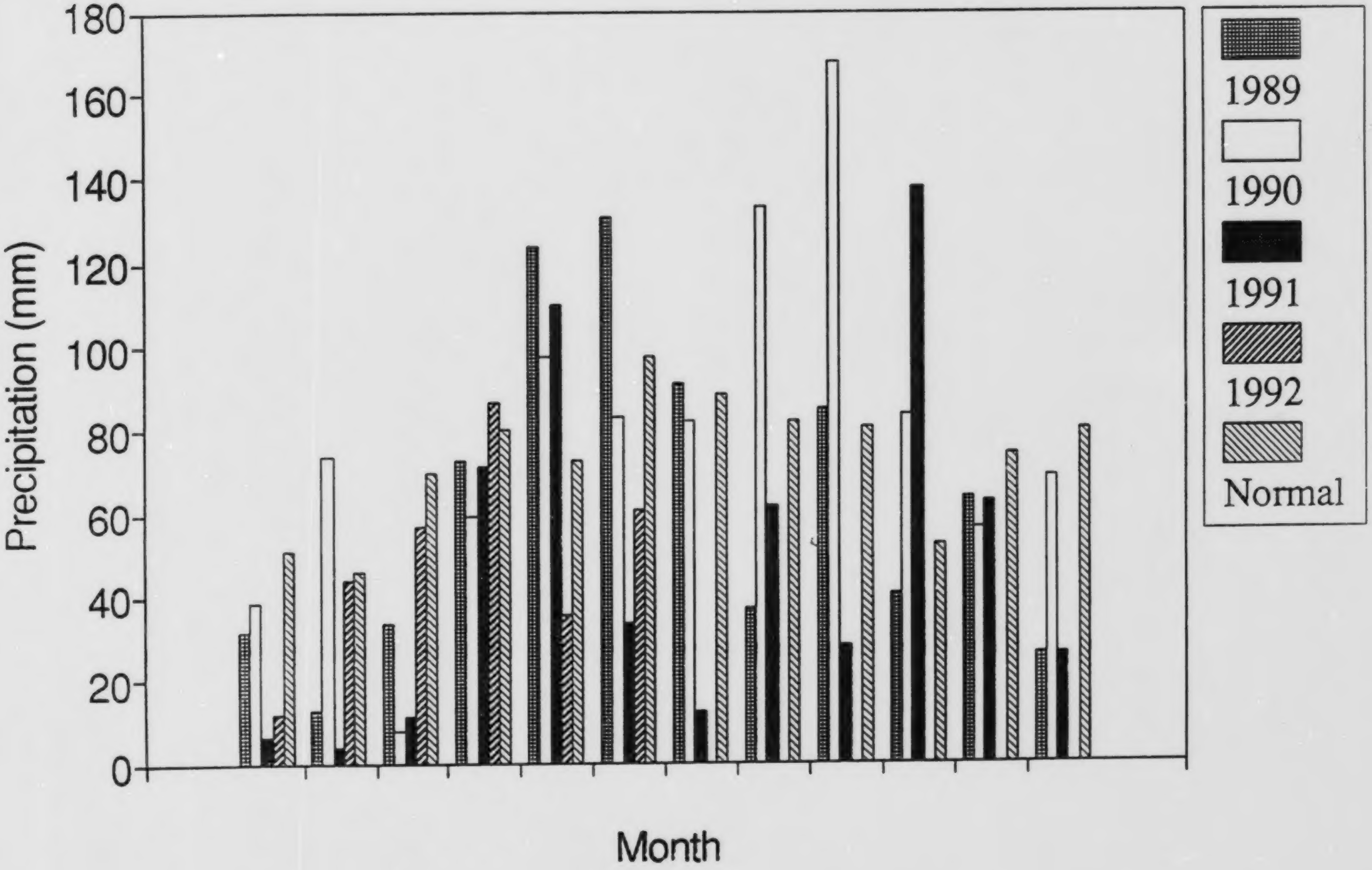


Figure 4.8: Kettle Creek Watershed Monthly Precipitation

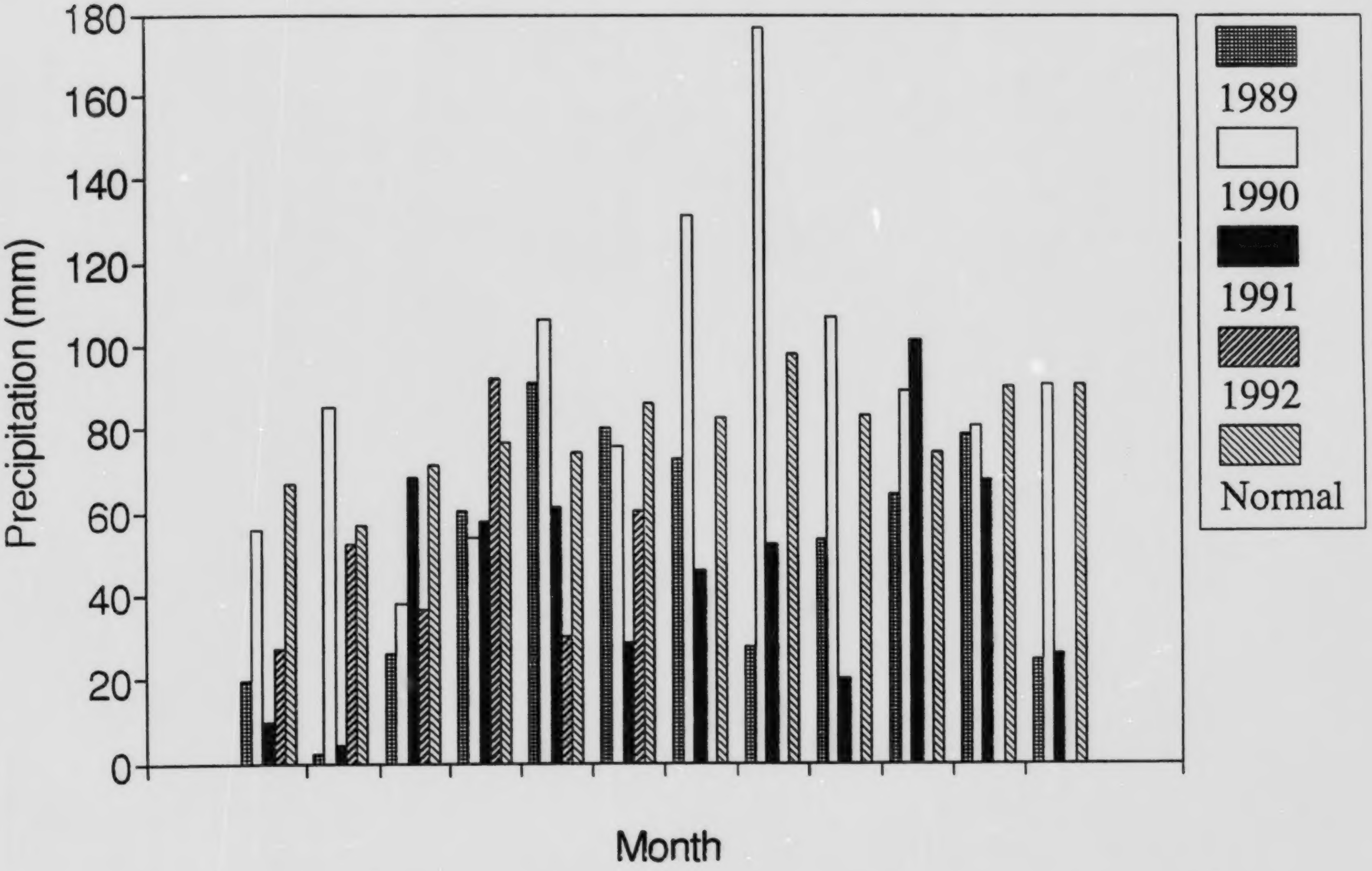


Figure 4.9: Pittock Watershed
Monthly Precipitation

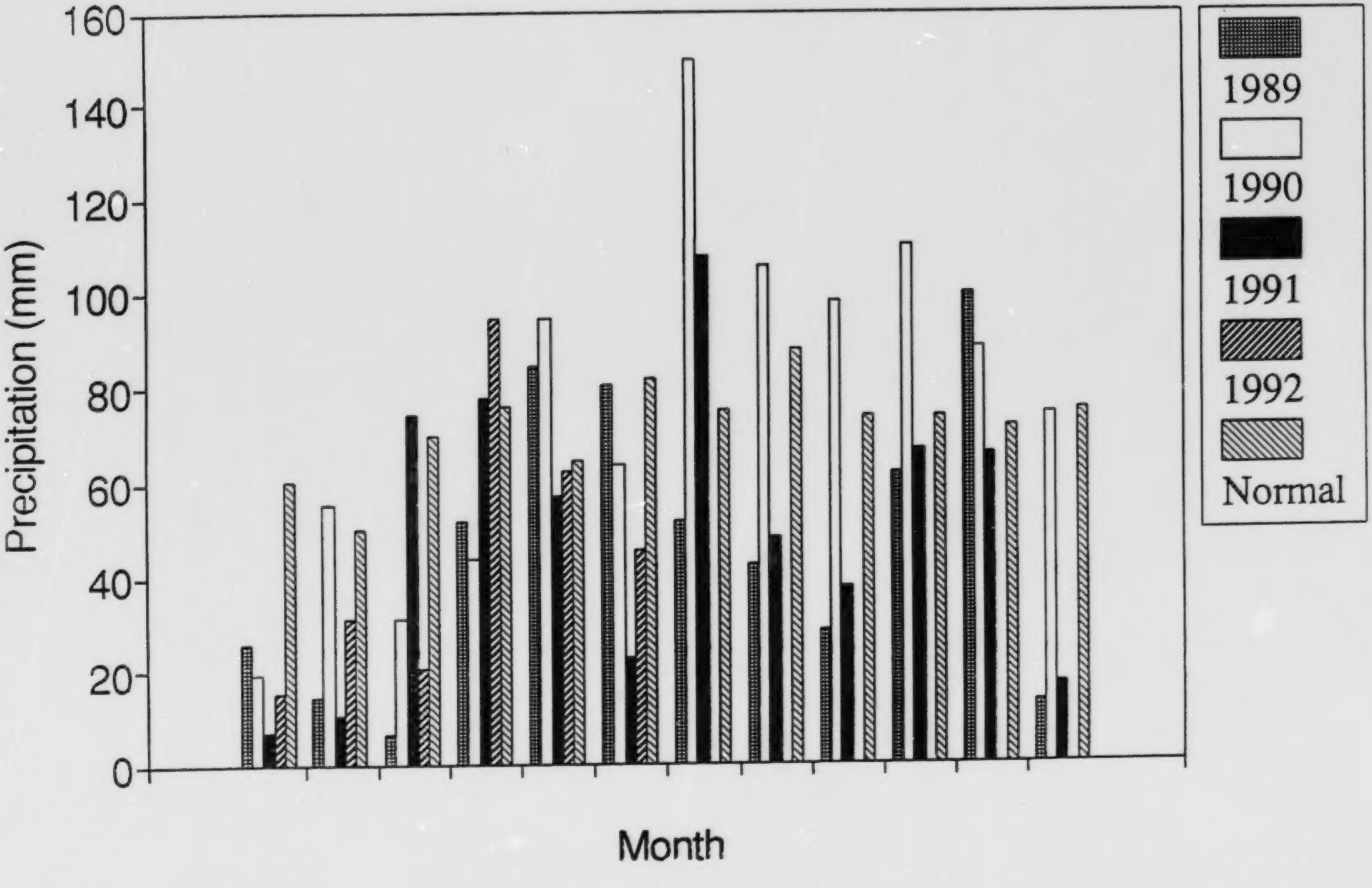


Figure 4.10

Daily Total Precipitation Distribution (1989-92)

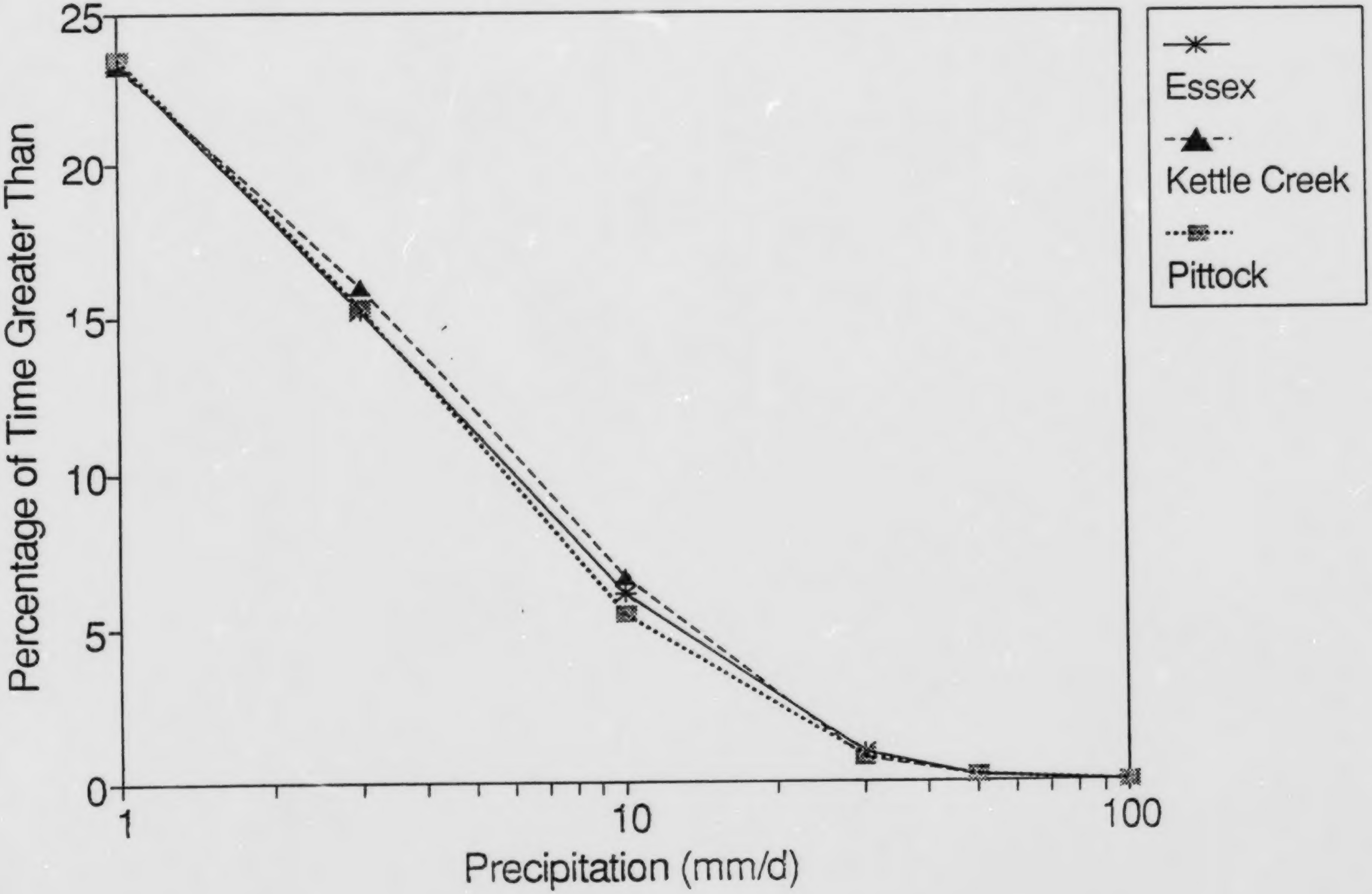
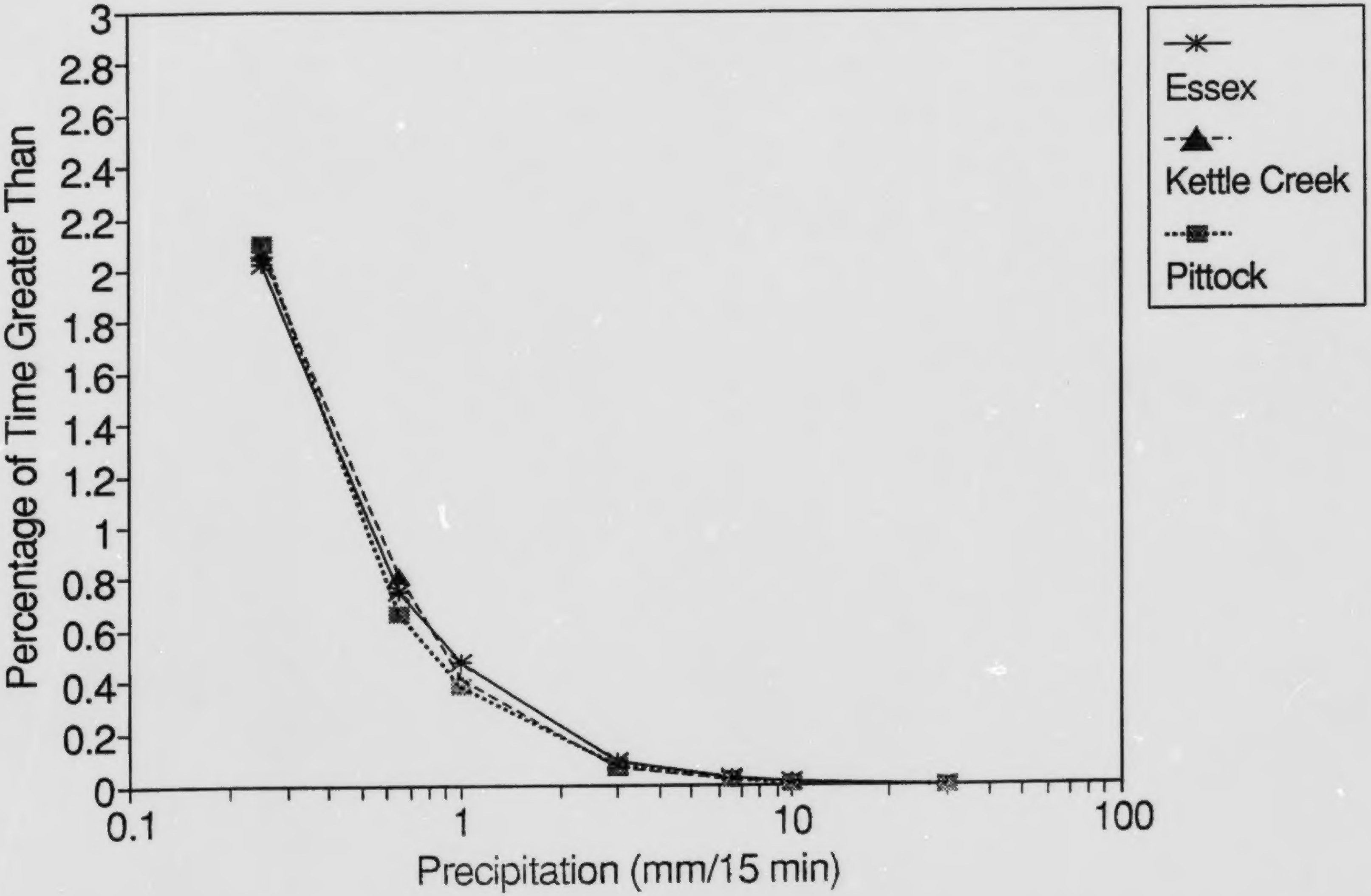


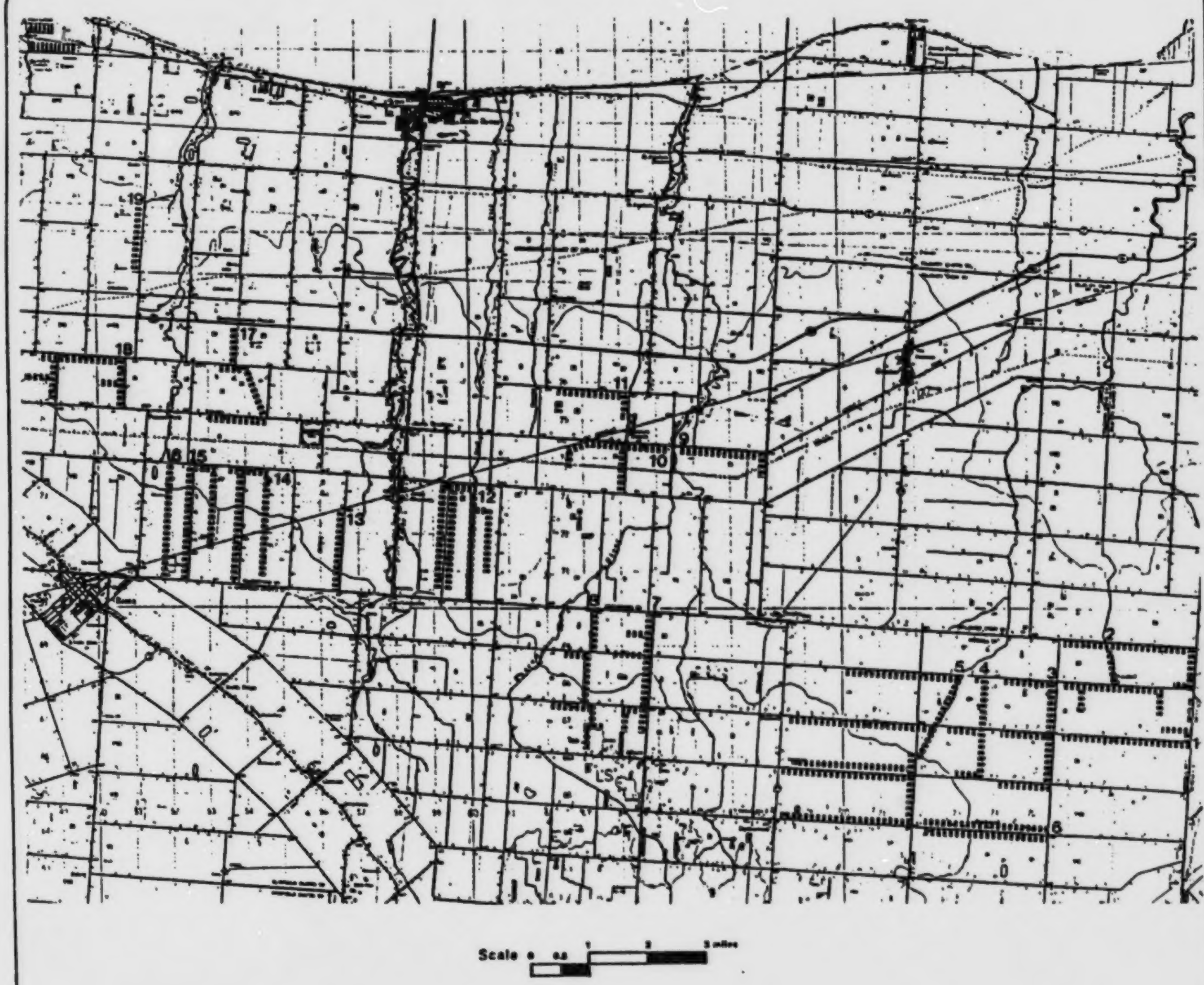
Figure 4.11
15 Minute Precipitation Distribution



APPENDIX A

CANDIDATE SUB-WATERSHED MAPPING

1. Candidate Sub-Watersheds - Watershed and Sub-Watershed Boundaries


1
2
3
4
5
6
9
10
11
12
13
14
15
16
17
18
19
Scale 0 0.5 1 2 3 miles

SWEEP

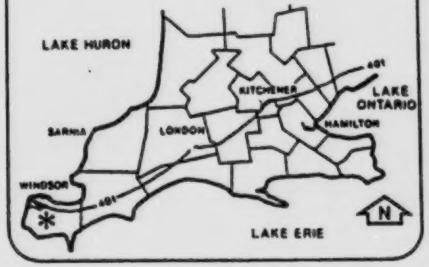
PILOT WATERSHED PROJECT

Canadä

Ontario

KEY MAP

* LOCATION OF AREA REPRESENTED ON THIS MAP


LAKE HURON
SARNIA
LONDON
KITCHENER
HAMILTON
401
LAKE ONTARIO
WINDSOR
401
*
LAKE ERIE
N

Legend

▪▪▪▪▪▪▪▪ - CANDIDATE SUB-WATERSHED DRAIN

1 - SUB-WATERSHED CODE

NOTE: -

FOR THE PRELIMINARY FIELD WORK SUB-WATERSHED DIVIDES COULD NOT BE IDENTIFIED.

CMS conservation management systems

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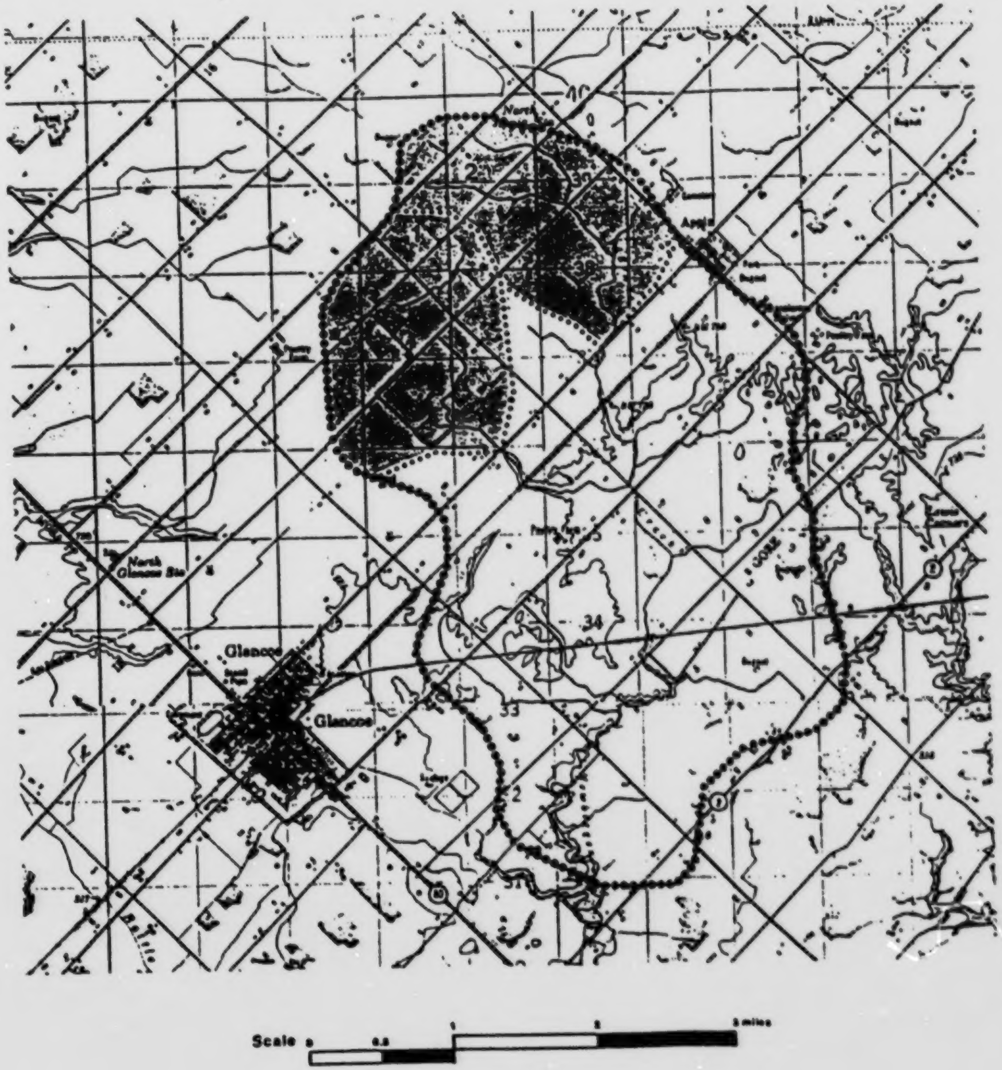
CANDIDATE SUB-WATERSHEDS

ESSEX AREA


North
Glencoe
Glencoe
North Glencoe Sta
34
33
2
Scale 0 0.5 1 2 3 miles

SWEEP

PILOT WATERSHED PROJECT

Canada Ontario

KEY MAP

✱ LOCATION OF AREA REPRESENTED ON THIS MAP

LAKE HURON
KITCHENER
401
LAKE ONTARIO
HAMILTON
SARNIA
LONDON
WINDSOR
401
N
LAKE ERIE

Legend

●●●●●● – WATERSHED BOUNDARY

······· – SUB-WATERSHED BOUNDARY

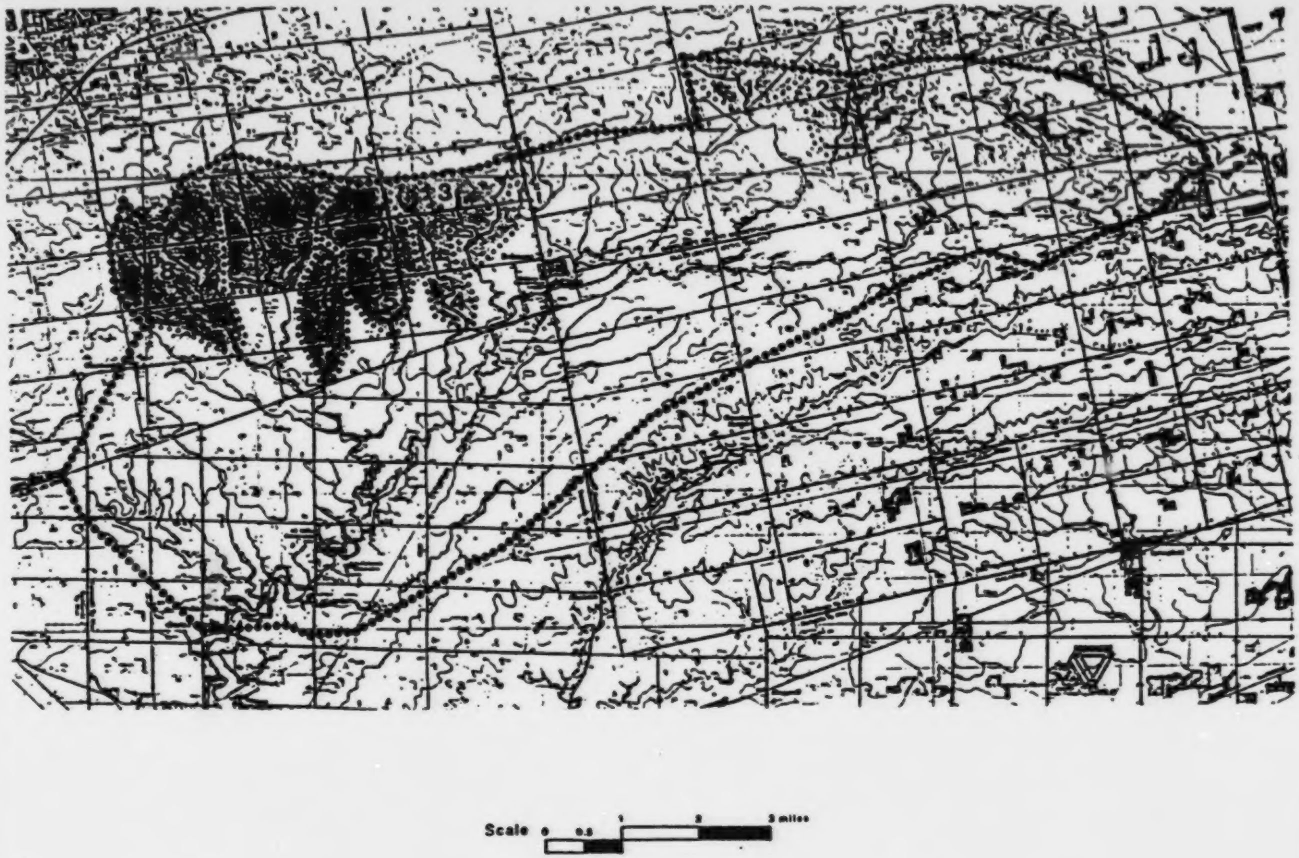
1 – SUB-WATERSHED CODE

CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHEDS

NEWBIGGEN CREEK



1
2
3
Scale 0 0.5 1 2 3 miles

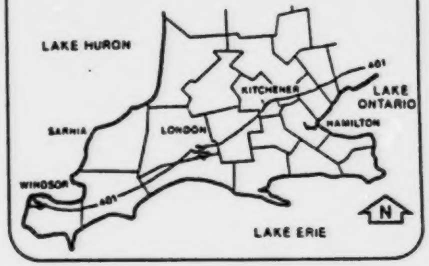
SWEEP
PILOT WATERSHED PROJECT

Canadä

Ontario

KEY MAP

* LOCATION OF AREA REPRESENTED ON THIS MAP



LAKE HURON
KITCHENER
401
LAKE ONTARIO
SARNIA
LONDON
HAMILTON
WINDSOR
401
N
LAKE ERIE

Legend

●●●●●● - WATERSHED BOUNDARY

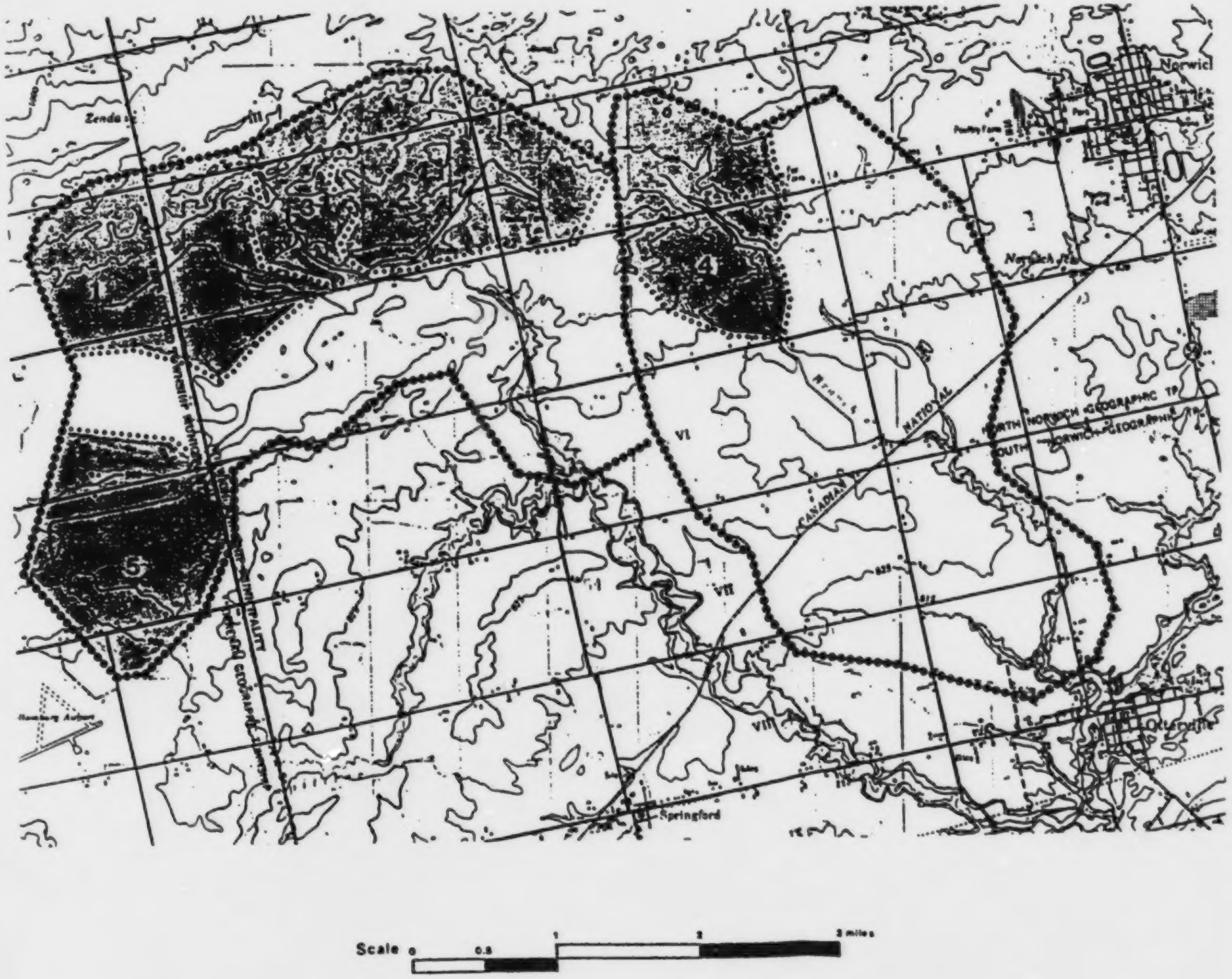
······· - SUB-WATERSHED BOUNDARY

1 - SUB-WATERSHED CODE

CMS conservation
management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHEDS
KETTLE CREEK


Norwich
Zenda
Springford
Otterville
1
2
3
4
5
III
V
VI
VII
VIII
NORTH NORWICH GEOGRAPHIC TP
SOUTH NORWICH GEOGRAPHIC TP
CANADIAN NATIONAL
Scale 0 0.5 1 2 3 miles

SWEEP
PILOT WATERSHED PROJECT

Canada
Ontario

KEY MAP

* LOCATION OF AREA REPRESENTED ON THIS MAP
LAKE HURON
KITCHENER
LAKE ONTARIO
401
HAMILTON
SARNIA
LONDON
WINDSOR
401
LAKE ERIE
N

Legend

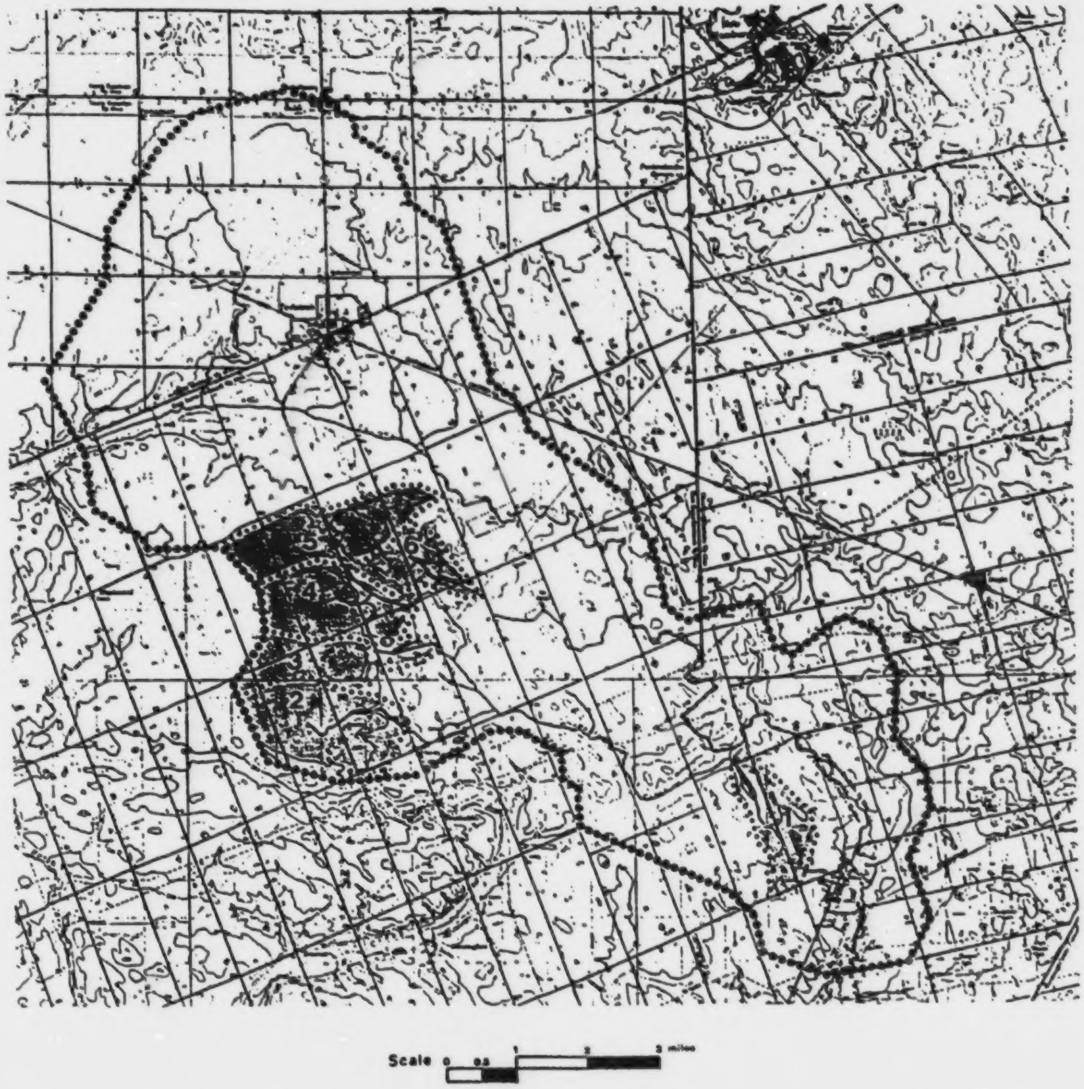
●●●●●● - WATERSHED BOUNDARY

······· - SUB-WATERSHED BOUNDARY

1 - SUB-WATERSHED CODE

CMS conservation management systems
CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHEDS
SPITTLER BASIN


Scale 0 0.5 1 2 3 miles

SWEEP

PILOT WATERSHED PROJECT

Canadä   Ontario

KEY MAP

* LOCATION OF AREA REPRESENTED ON THIS MAP

LAKE HURON
401
KITCHENER
LAKE ONTARIO
SARNIA
LONDON
HAMILTON
WINDSOR
401
N
LAKE ERIE

Legend

●●●●●● - WATERSHED BOUNDARY

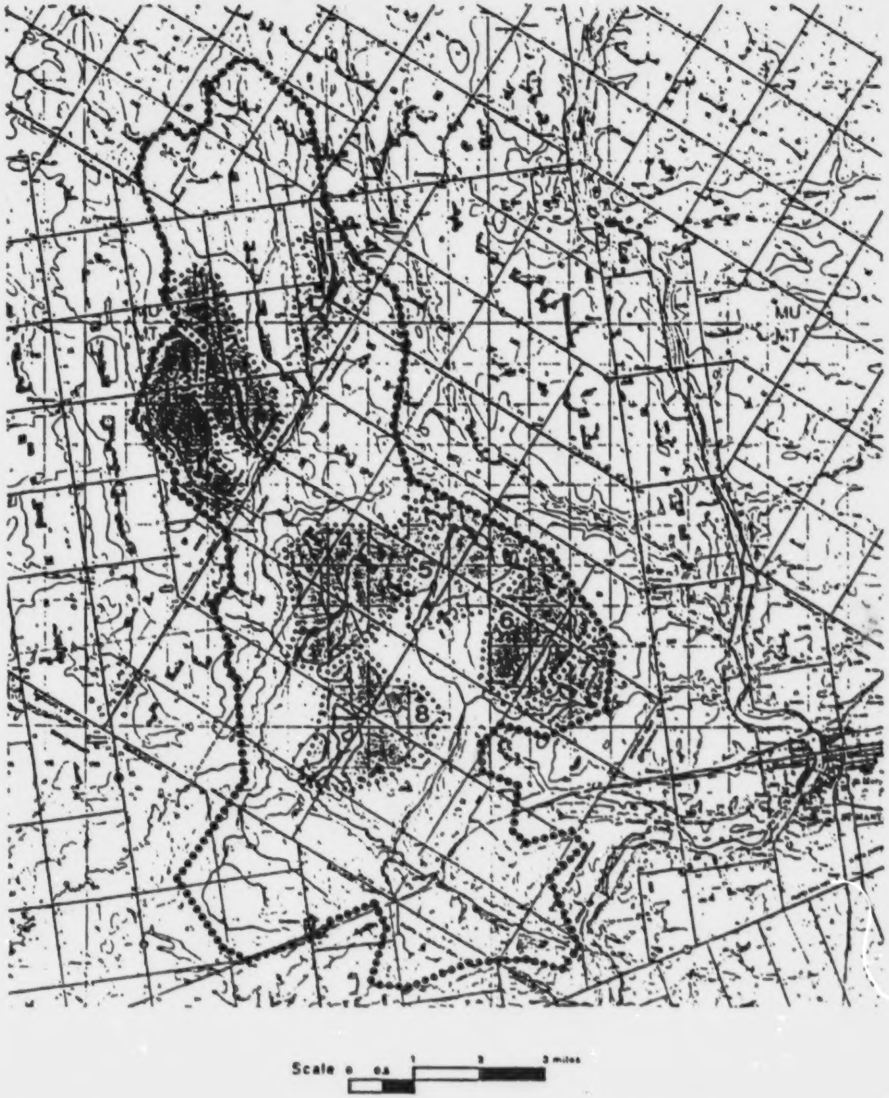
······· - SUB-WATERSHED BOUNDARY

1 - SUB-WATERSHED CODE

CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHEDS
PITTOCK RESERVOIR BASIN


MU
NT
4
5
6
7
8
Scale 0 0.5 1 2 3 miles

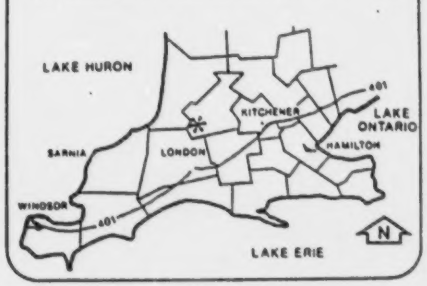
SWEEP

PILOT WATERSHED PROJECT

Canada Ontario

KEY MAP

* LOCATION OF AREA REPRESENTED ON THIS MAP


LAKE HURON
KITCHENER
401
LAKE ONTARIO
SARNIA
LONDON
HAMILTON
WINDSOR
401
LAKE ERIE
N

Legend

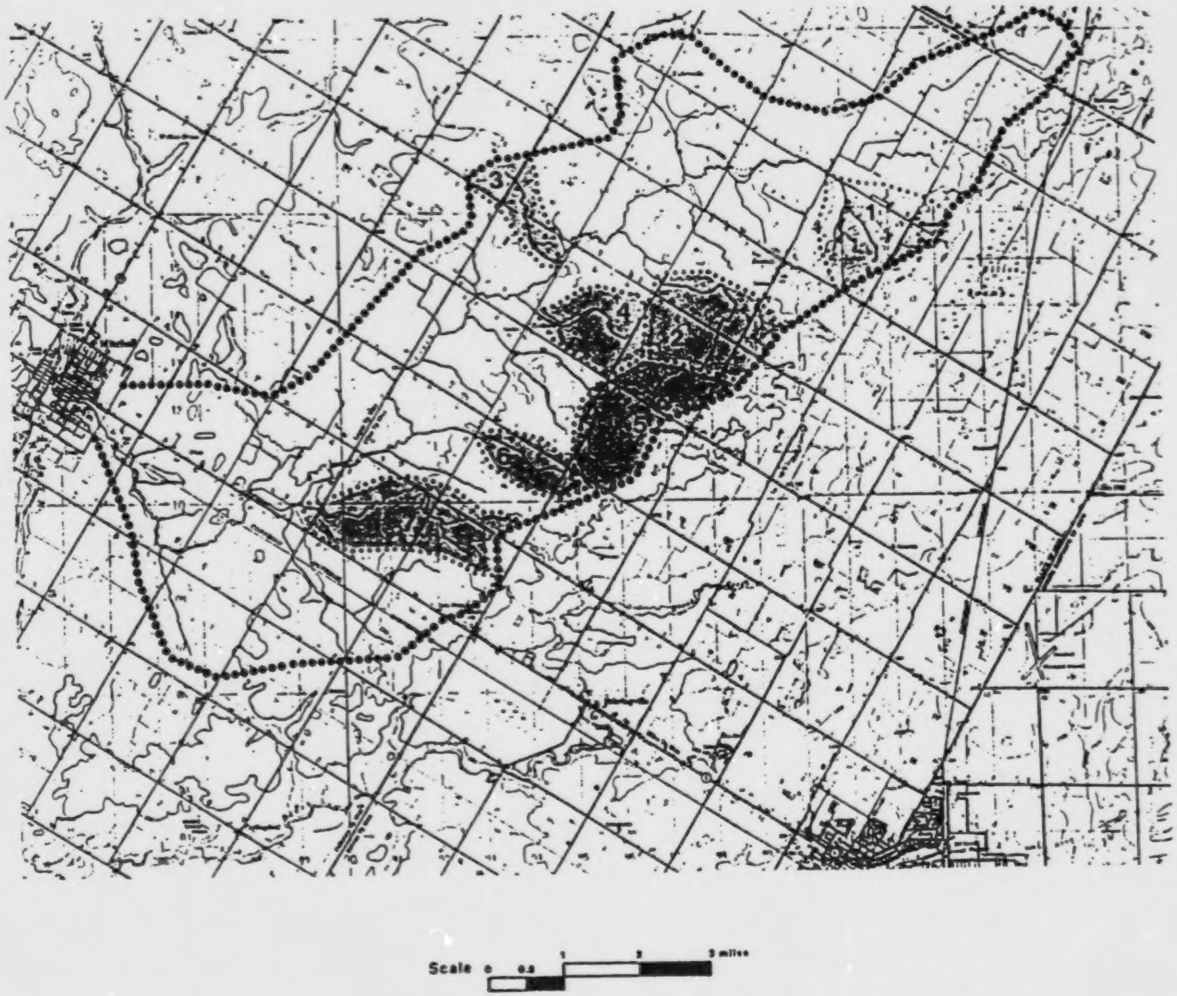
●●●●●● - WATERSHED BOUNDARY
•••••••• - SUB-WATERSHED BOUNDARY
1 - SUB-WATERSHED CODE

CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHEDS

FISH CREEK

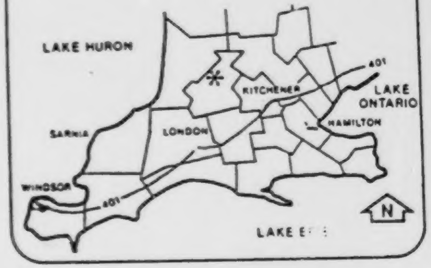

3
1
4
2
5
6
7
Scale 0 0.5 1 2 3 miles

PILOT WATERSHED PROJECT

Canada

Ontario

KEY MAP


LAKE HURON
KITCHENER
401
LAKE ONTARIO
HAMILTON
SARNIA
LONDON
WINDSOR
401
LAKE ERIE
N

* LOCATION OF AREA REPRESENTED ON THIS MAP

Legend

●●●●●● - WATERSHED BOUNDARY

·········· - SUB-WATERSHED BOUNDARY

1 - SUB-WATERSHED CODE

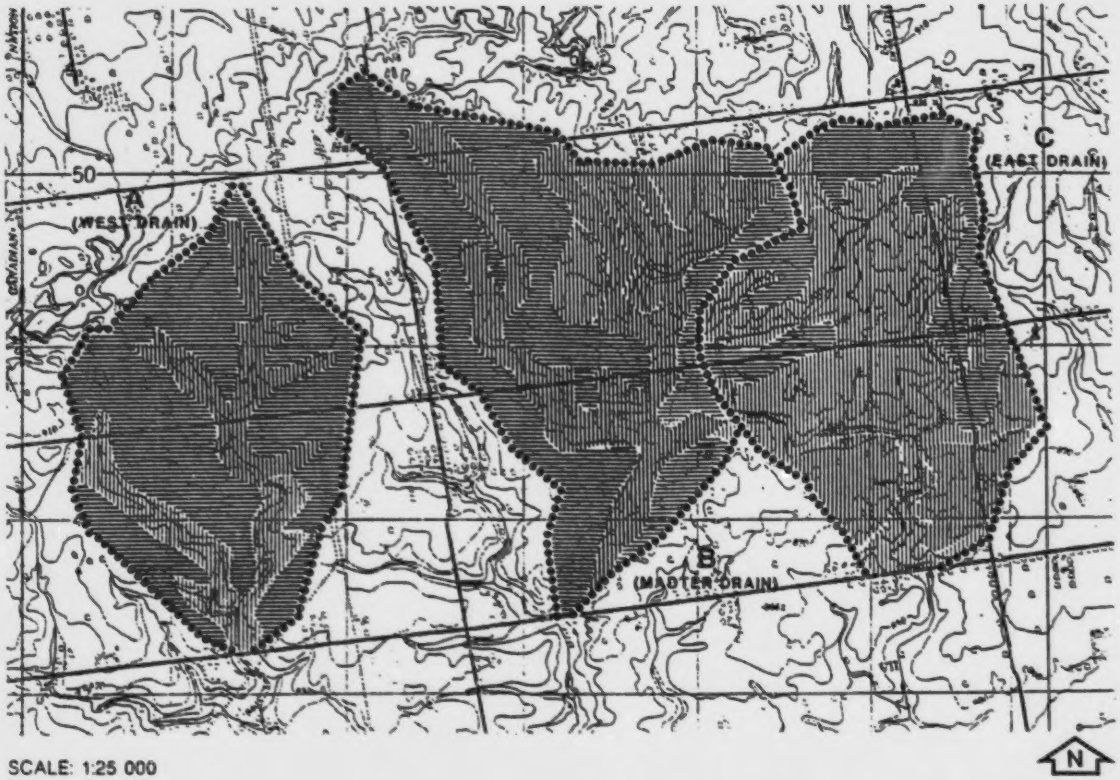
CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHEDS

WHIRL CREEK

2. Candidate Sub-Watersheds - Soils, Drainage, Land Use and Farm Systems Maps



SCALE: 1:25 000

SWEEP
PILOT WATERSHED PROJECT

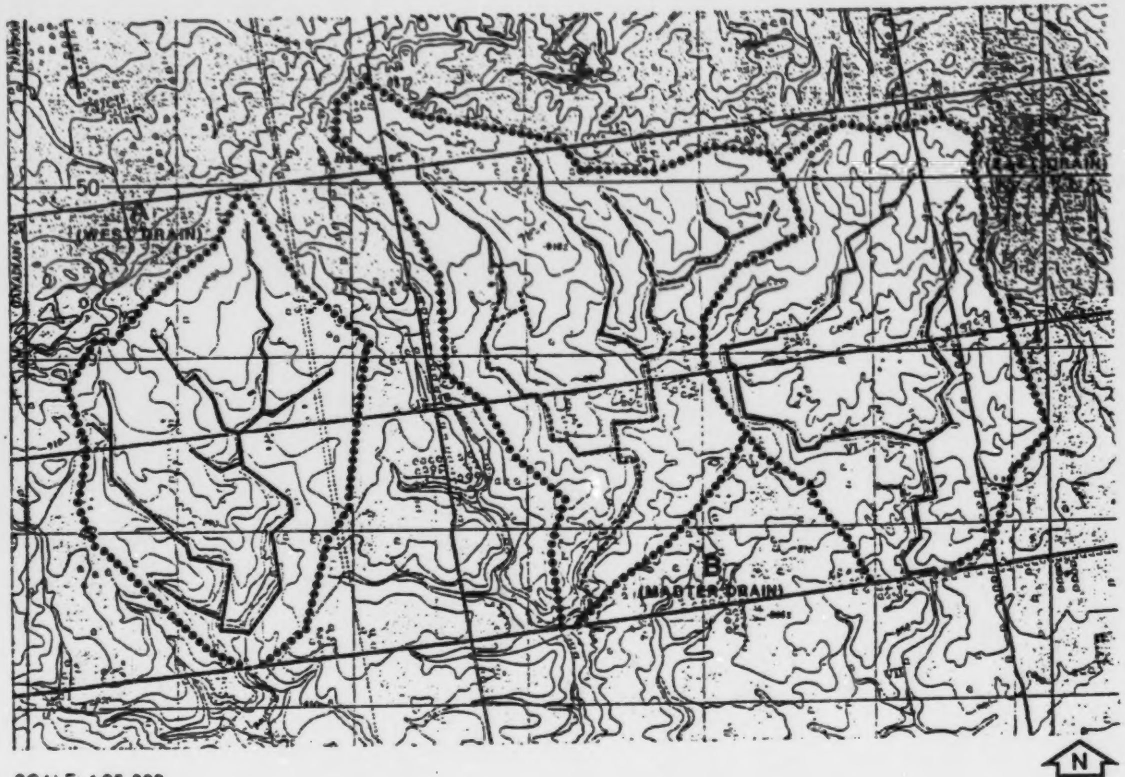
Canada   Ontario

Legend

	SOIL TYPE	SURFACE TEXTURE	DRAINAGE
▤	HURON	SILT LOAM, CLAY LOAM, SILTY CLAY LOAM	WELL
▥	BROOKSTON	SILT LOAM, CLAY LOAM, SILTY CLAY LOAM	POOR
▥	BENNINGTON	LOAM or SILT LOAM	WELL
▥	COLWOOD	LOAM, SILT LOAM, VERY FINE SANDY LOAM	POOR
▤	BRANT	LOAM, SILT LOAM, VERY FINE SANDY LOAM	WELL

CMS conservation
management systems
CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED
KETTLE CREEK
SOILS


50
A
(WEST DRAIN)
B
(MASTER DRAIN)
(EAST DRAIN)
N

SCALE: 1:25 000

SWEEP

PILOT WATERSHED PROJECT

Canada
Ontario

Legend

——— - NATURAL WATERCOURSE

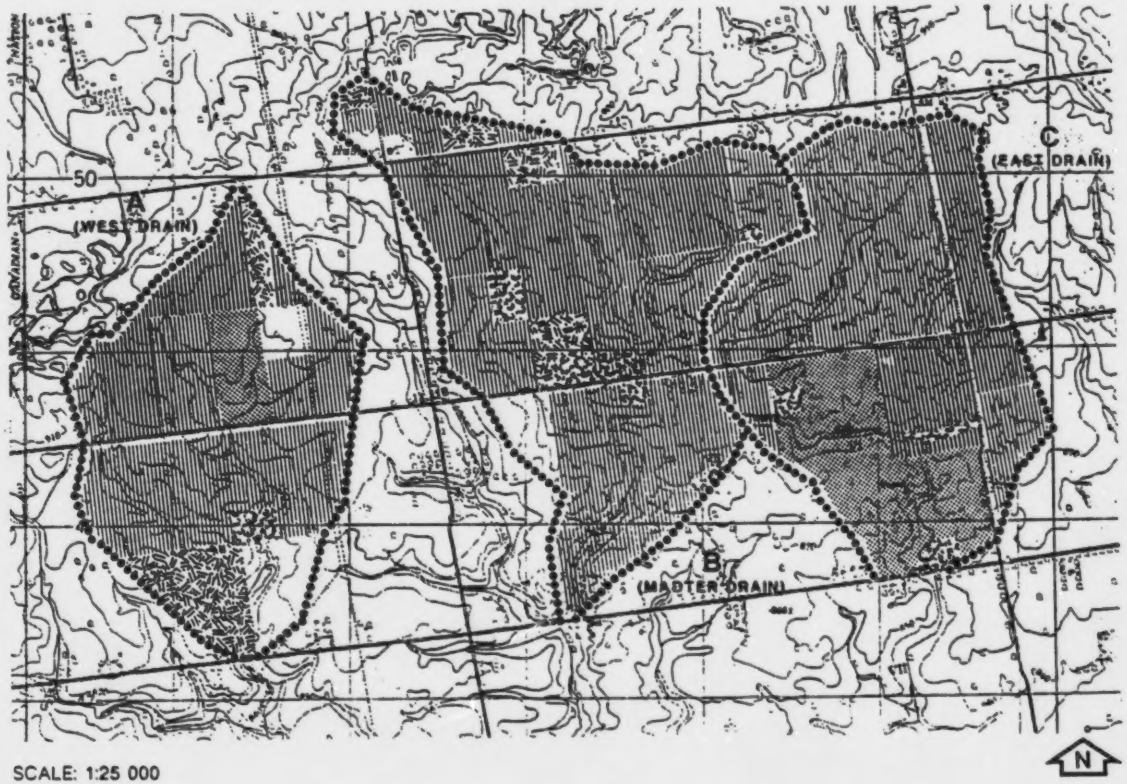
········ - OPEN MUNICIPAL DRAIN

– – – - COVERED MUNICIPAL DRAIN

CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED
KETTLE CREEK
DRAINAGE


50
A
(WEST DRAIN)
B
(MADTER DRAIN)
C
(EAST DRAIN)
N

SCALE: 1:25 000

SWEEP

PILOT WATERSHED PROJECT

Canada

Ontario

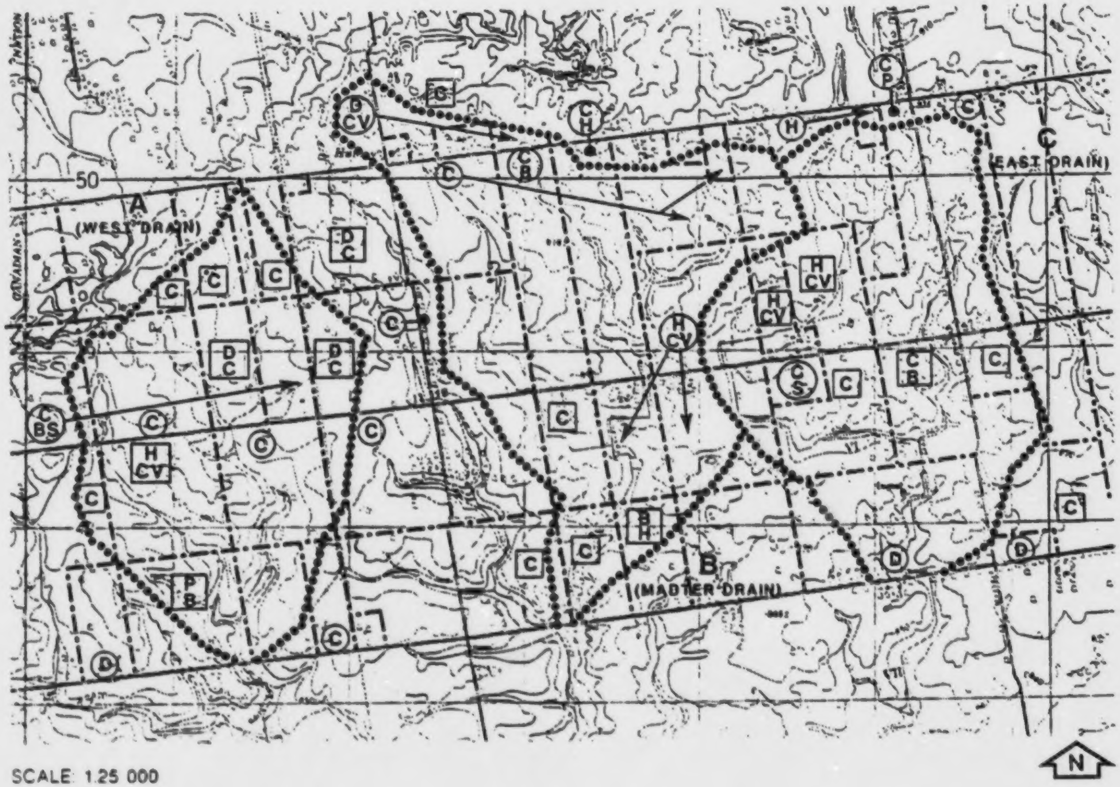
Legend

- ▥ - ROW CROPS
- ▥ - CORN/GRAIN SYSTEMS
- ▨ - HAY ROTATION
- ▩ - PASTURE
- ▩ - WOODLOT
- ☐ - NON-AGRICULTURAL OR USE UNKNOWN

CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED
KETTLE CREEK
LAND USE



SCALE: 1.25 000

SWEEP
PILOT WATERSHED PROJECT

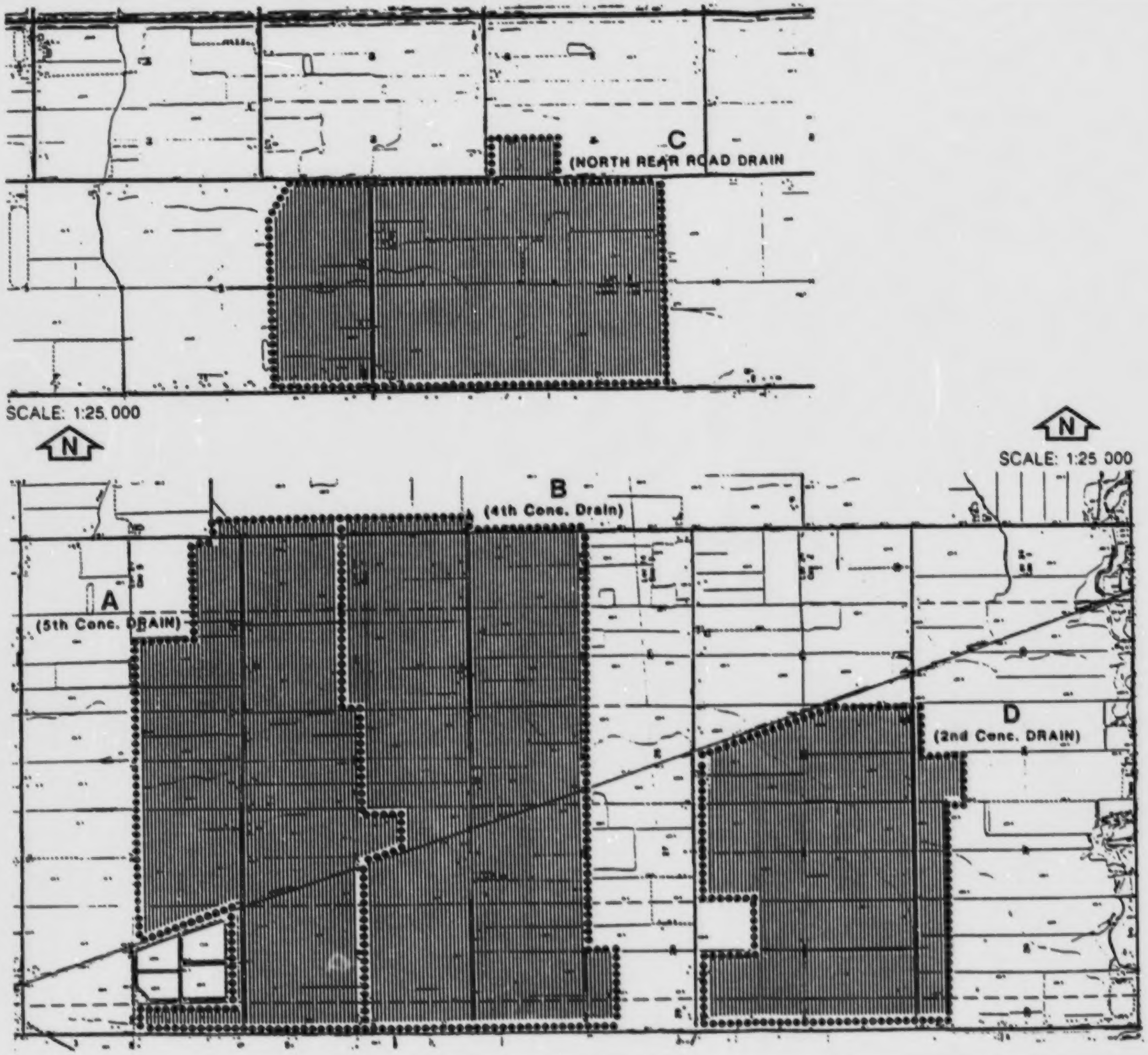
Canada Ontario

Legend

-·-·- PROPERTY BOUNDARY
C - CASH CROP
D - DAIRY
H - HOGS
B - BEEF
V - VEAL
P - POULTRY
S - SHEEP
○ HEADQUARTERS LOCATED ON PROPERTY
□ HEADQUARTERS NOT LOCATED ON PROPERTY
○↘ OTHER LOCAL PROPERTY ASSOCIATED WITH HEADQUARTERS

CMS conservation management systems
CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED
KETTLE CREEK
FARM SYSTEMS


C
(NORTH REAR ROAD DRAIN
SCALE: 1:25,000
N
A
(5th Conc. DRAIN)
B
(4th Conc. Drain)
SCALE: 1:25 000
N
D
(2nd Conc. DRAIN)

SWEEP

PILOT WATERSHED PROJECT

Canada

Ontario

Legend

	SOIL TYPE	SURFACE TEXTURE	DRAINAGE
▥	BROOKSTON	SILTY CLAY LOAM	POOR

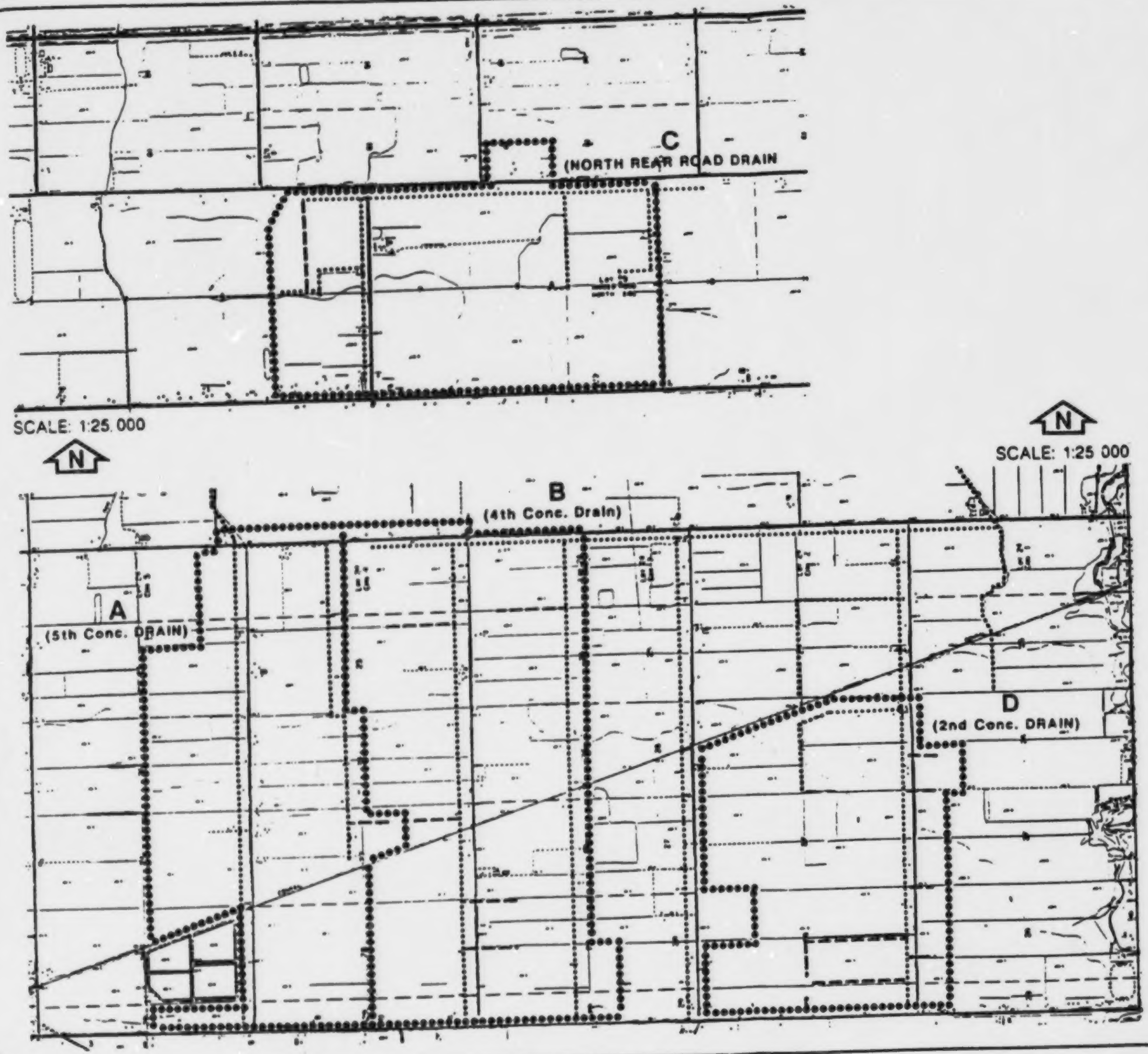
CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED

ESSEX AREA

SOILS


C
(NORTH REAR ROAD DRAIN
SCALE: 1:25.000
N
B
(4th Conc. Drain)
A
(5th Conc. DRAIN)
D
(2nd Conc. DRAIN)
N
SCALE: 1:25 000

SWEEP

PILOT WATERSHED PROJECT

Canada
Ontario

Legend

– – –	NATURAL WATERCOURSE
········	OPEN MUNICIPAL DRAIN

CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

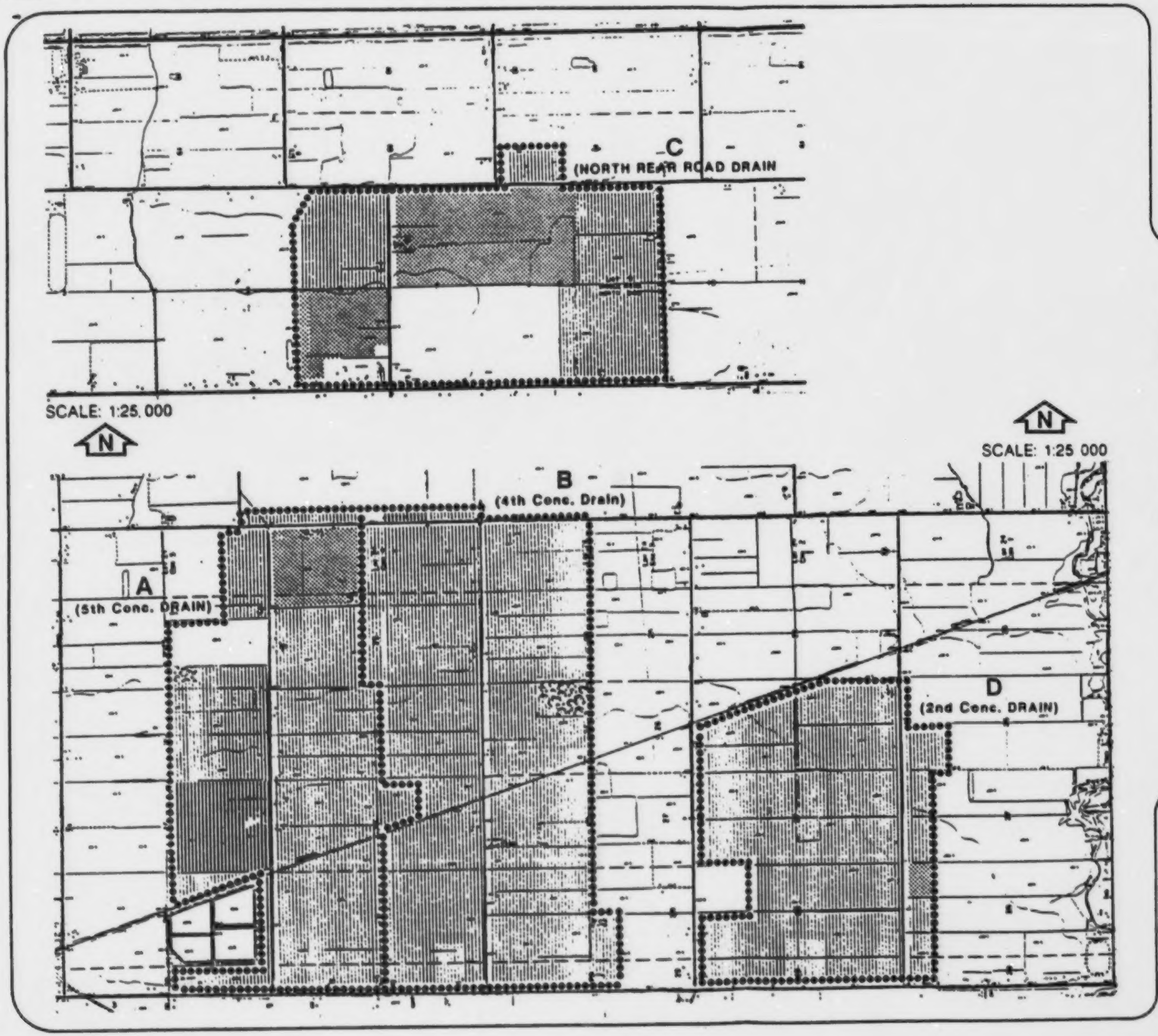
CANDIDATE SUB-WATERSHED
ESSEX AREA
DRAINAGE

SWEEP

PILOT WATERSHED PROJECT

Canada

Ontario


C
(NORTH REAR ROAD DRAIN
SCALE: 1:25,000
N
SCALE: 1:25 000
N
B
(4th Conc. Drain)
A
(5th Conc. DRAIN)
D
(2nd Conc. DRAIN)

Legend

- ▥ - ROW CROPS
- ▤ - CORN/GRAIN SYSTEMS
- ▩ - HAY ROTATION
- ▦ - WOODLOT
- ☐ - NON-AGRICULTURAL OR USE UNKNOWN

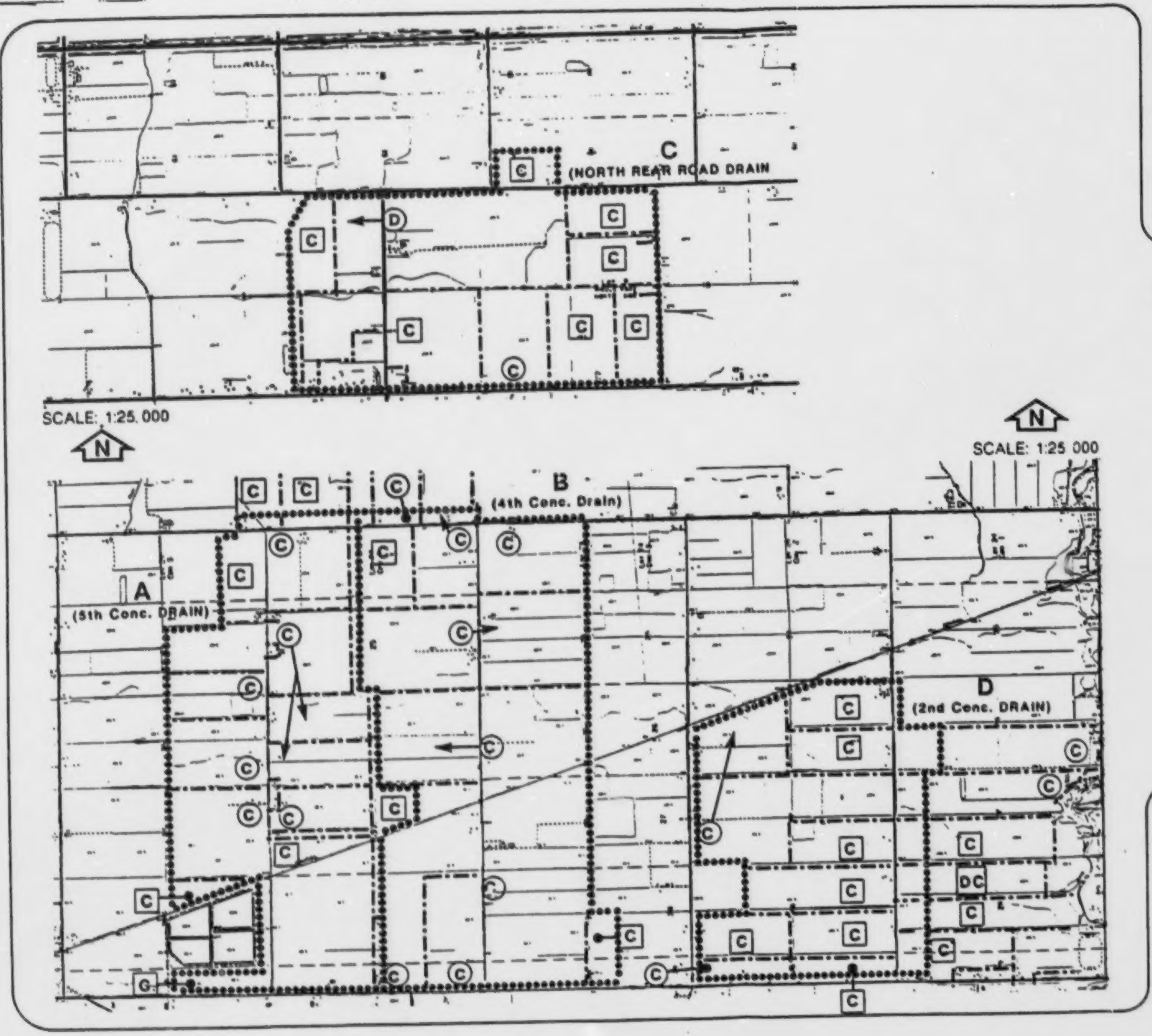
CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED

ESSEX AREA

LAND USE


C
(NORTH REAR ROAD DRAIN)
SCALE: 1:25, 000
N
A
(5th Conc. DRAIN)
B
(4th Conc. Drain)
D
(2nd Conc. DRAIN)
SCALE: 1:25 000
N
C
D
DC

SWEEP
PILOT WATERSHED PROJECT
Canada
Ontario

Legend

-·-·-· PROPERTY BOUNDARY
C - CASH CROP
D - DAIRY
○ HEADQUARTERS LOCATED ON PROPERTY
☐ HEADQUARTERS NOT LOCATED ON PROPERTY
○ OTHER LOCAL PROPERTY ASSOCIATED WITH HEADQUARTERS

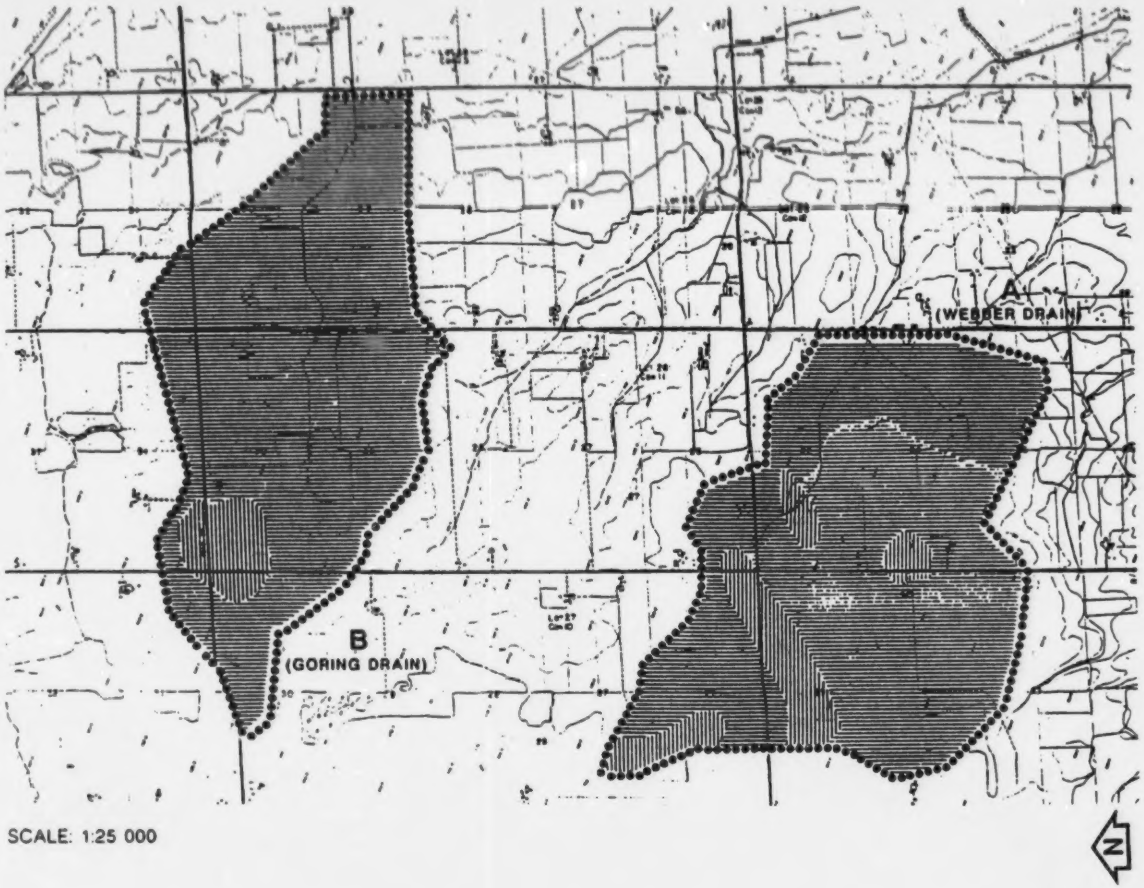
CMS conservation management systems
CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED
ESSEX AREA
FARM SYSTEMS

SWEEP

PILOT WATERSHED PROJECT

Canada Ontario



SCALE: 1:25 000

Legend

	SOIL TYPE	SURFACE TEXTURE	DRAINAGE
▤	EMBRO	SILT LOAM	IMPERFECT
░	CROMBIE	SILT LOAM	POOR
▤	TAVISTOCK	SILT LOAM	IMPERFECT
▥	MAPLEWOOD	SILT LOAM	POOR

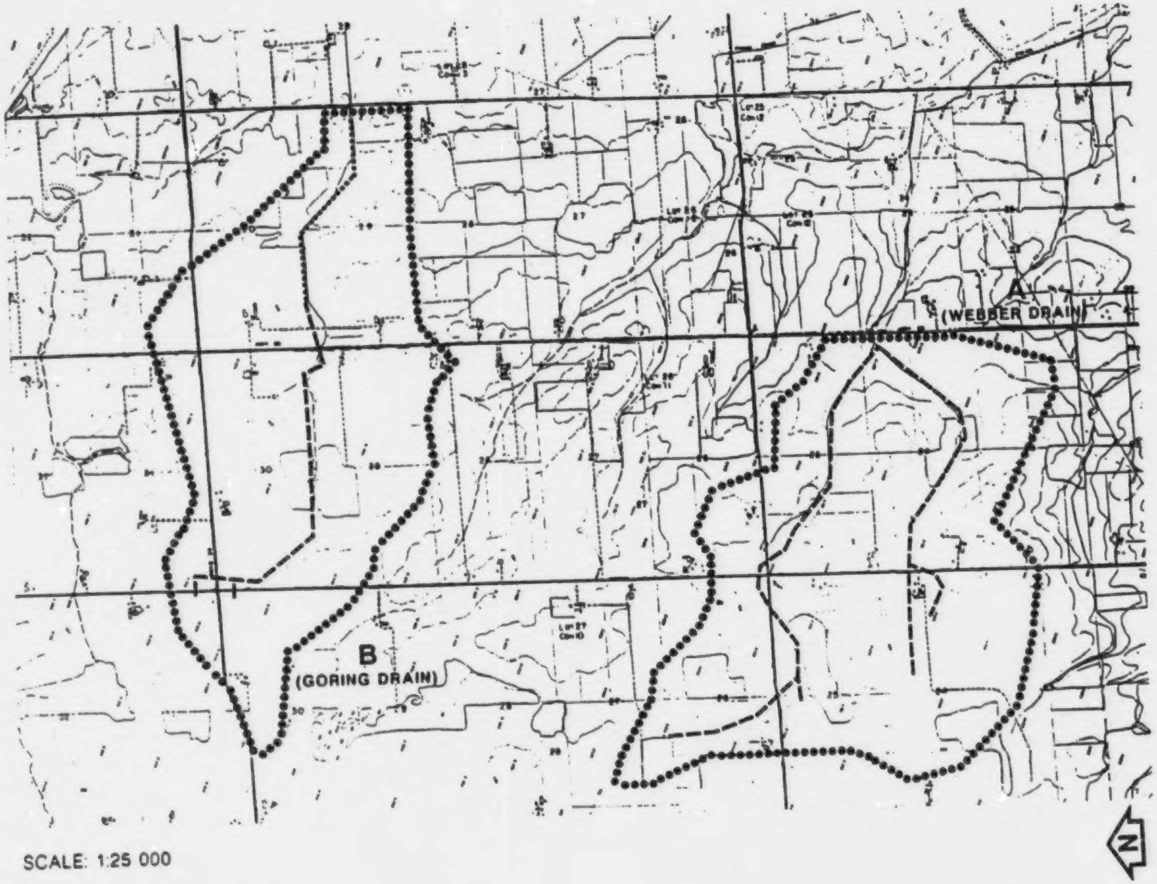
CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED

PITTOCK RESERVOIR BASIN

SOILS


A
(WEBBER DRAIN)
B
(GORING DRAIN)
N

SCALE: 1:25 000

SWEEP
PILOT WATERSHED PROJECT

Canada
Ontario

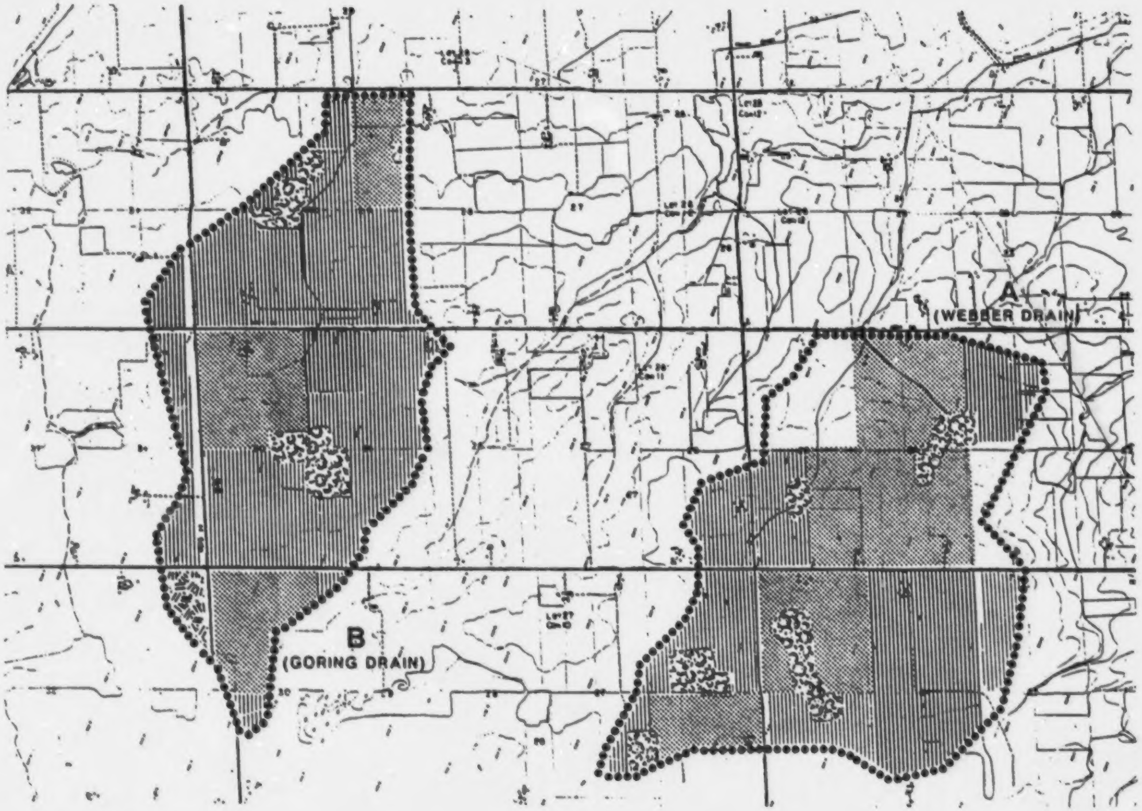
Legend

.... OPEN MUNICIPAL DRAIN

— — — COVERED MUNICIPAL DRAIN

CMS conservation management systems
CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED
PITTOCK RESERVOIR BASIN
DRAINAGE



SCALE: 1:25 000

SWEEP

PILOT WATERSHED PROJECT

Canadä Ontario

Legend

- ▥ - ROW CROPS
- ▥ - CORN/GRAIN SYSTEMS
- ▨ - HAY ROTATION
- ▩ - PASTURE
- ▩ - WOODLOT
- ☐ - NON-AGRICULTURAL OR USE UNKNOWN

CMS conservation management systems

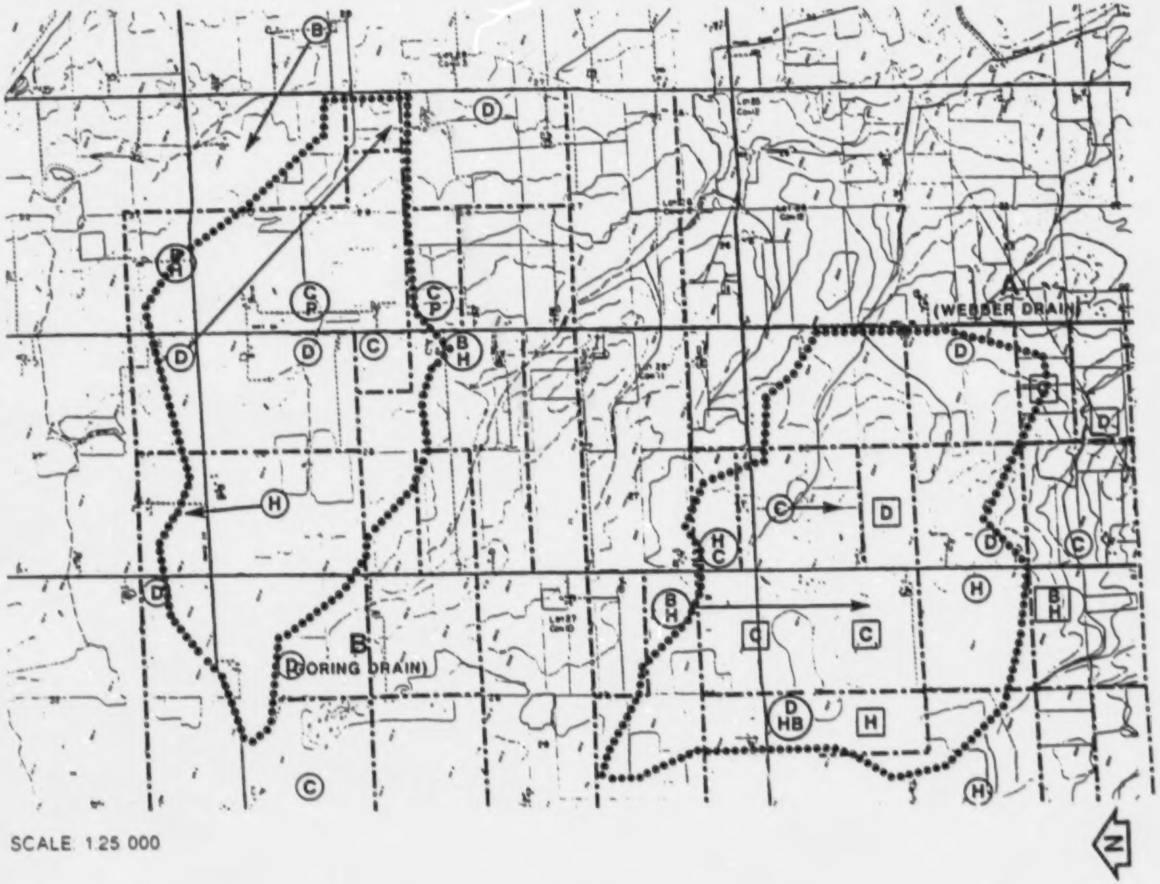
CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED
PITTOCK RESERVOIR BASIN
LAND USE

SWEEP

PILOT WATERSHED PROJECT

Canada Ontario



SCALE 1:25 000

Legend

- –·–·– PROPERTY BOUNDARY
- C – CASH CROP
- D – DAIRY
- H – HOGS
- B – BEEF
- P – POULTRY
- ○ HEADQUARTERS LOCATED ON PROPERTY
- ☐ HEADQUARTERS NOT LOCATED ON PROPERTY
- ○↘ OTHER LOCAL PROPERTY ASSOCIATED WITH HEADQUARTERS

CMS conservation management systems

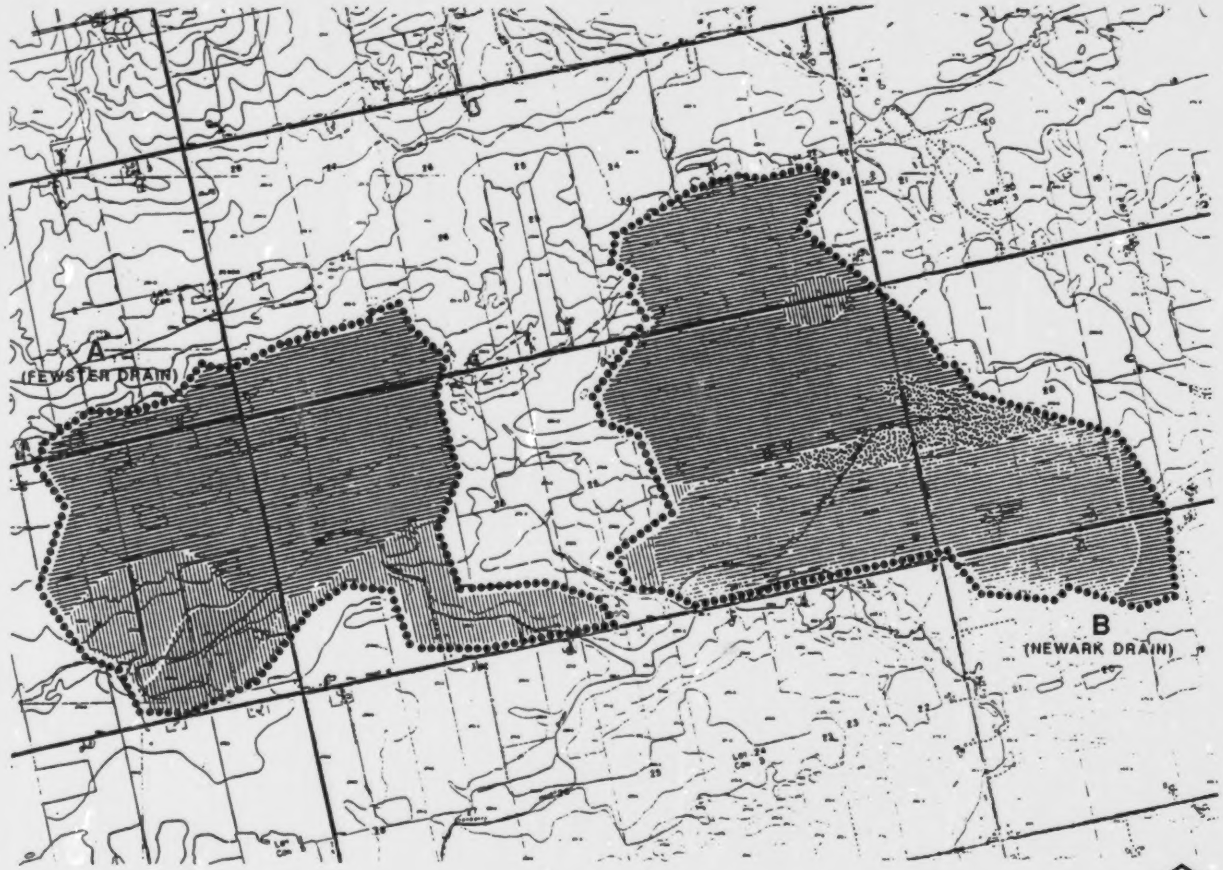
CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED
PITTOCK RESERVOIR BASIN
FARM SYSTEMS

SWEEP

PILOT WATERSHED PROJECT

Canada ⊛ Ontario



SCALE: 1:25 000

Legend

	SOIL TYPE	SURFACE TEXTURE	DRAINAGE
▤	HURON	CLAY LOAM	WELL
░	PERTH	SILT LOAM	IMPERFECT
▥	BROOKSTON	CLAY LOAM	POOR
▤	LISTOWEL	SILT LOAM	IMPERFECT
▓	MUCK	MUCK	VERY POOR

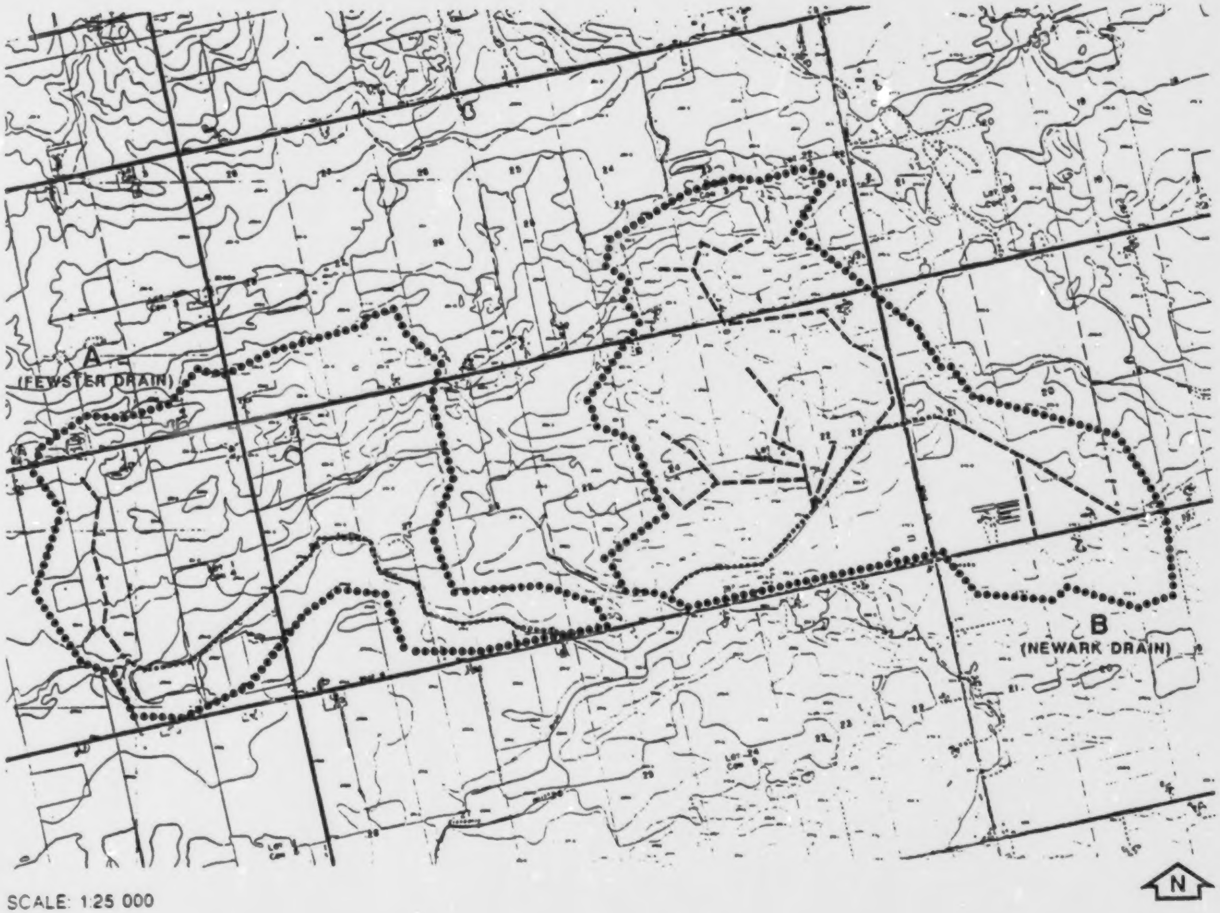
CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED

SPITTLER BASIN

SOILS


A
(FEWSTER DRAIN)
B
(NEWARK DRAIN)
N

SCALE: 1:25 000

SWEEP
PILOT WATERSHED PROJECT
Canada
Ontario

Legend

······· OPEN MUNICIPAL DRAIN
– – – COVERED MUNICIPAL DRAIN

CMS conservation management systems
CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

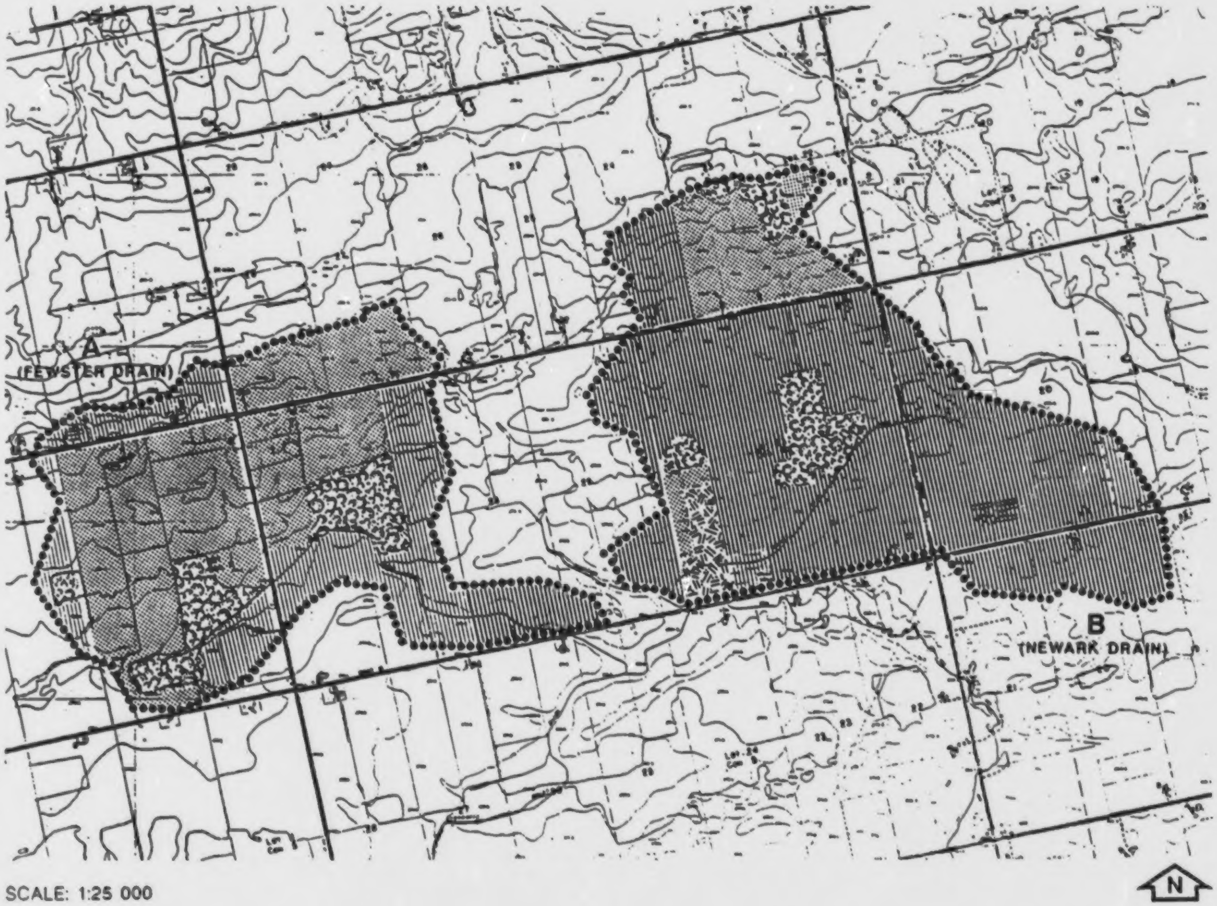
CANDIDATE SUB-WATERSHED
SPITTLER BASIN
DRAINAGE

SWEEP

PILOT WATERSHED PROJECT

Canada

Ontario


A
(FEWSTER DRAIN)
B
(NEWARK DRAIN)
N

SCALE: 1:25 000

Legend

- ▥ - ROW CROPS
- ▥ - CORN/GRAIN SYSTEMS
- ▨ - HAY ROTATION
- ▩ - PASTURE
- ▩ - WOODLOT

CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED
SPITTLER BASIN
LAND USE

SWEEP

PILOT WATERSHED PROJECT

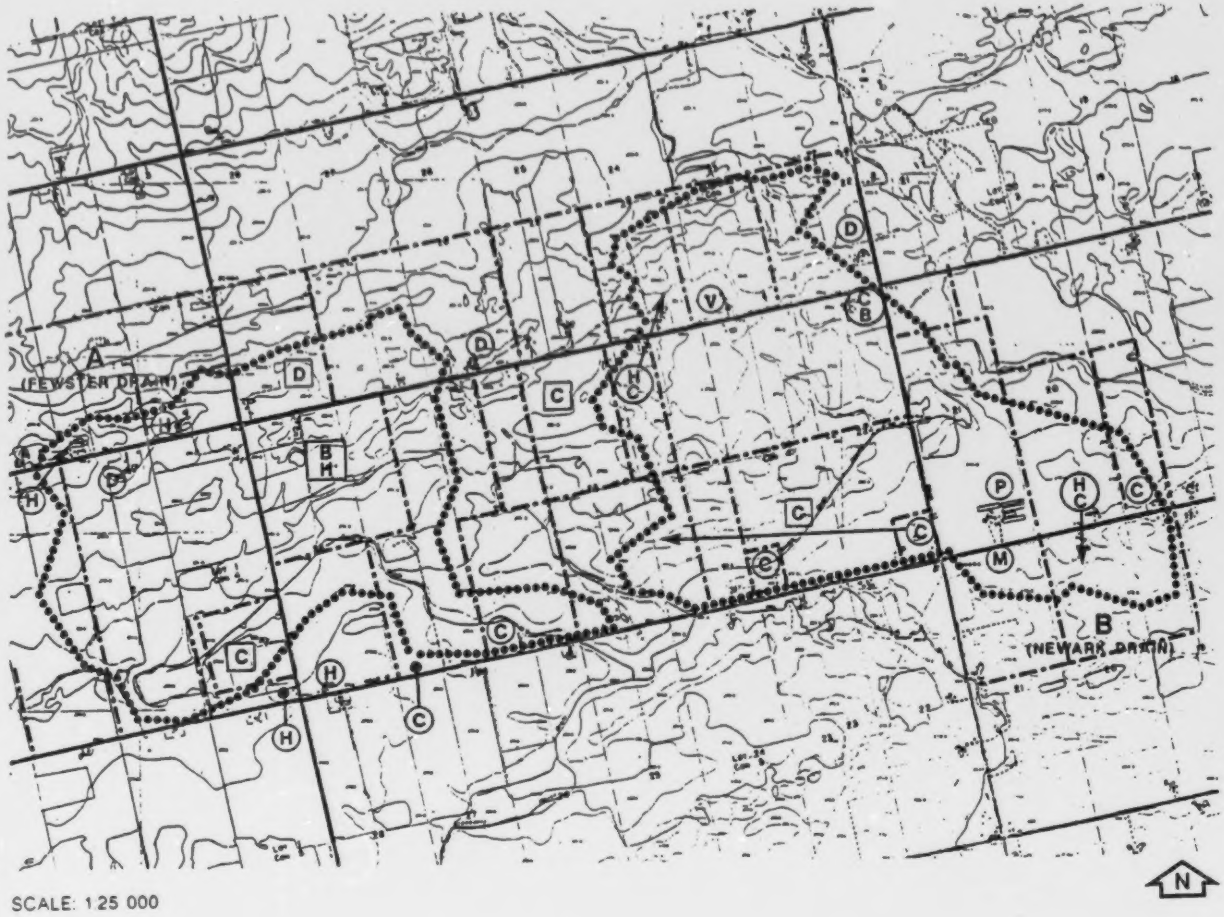
Canada

Ontario

CANDIDATE SUB-WATERSHED

SPITTLER BASIN

FARM SYSTEMS

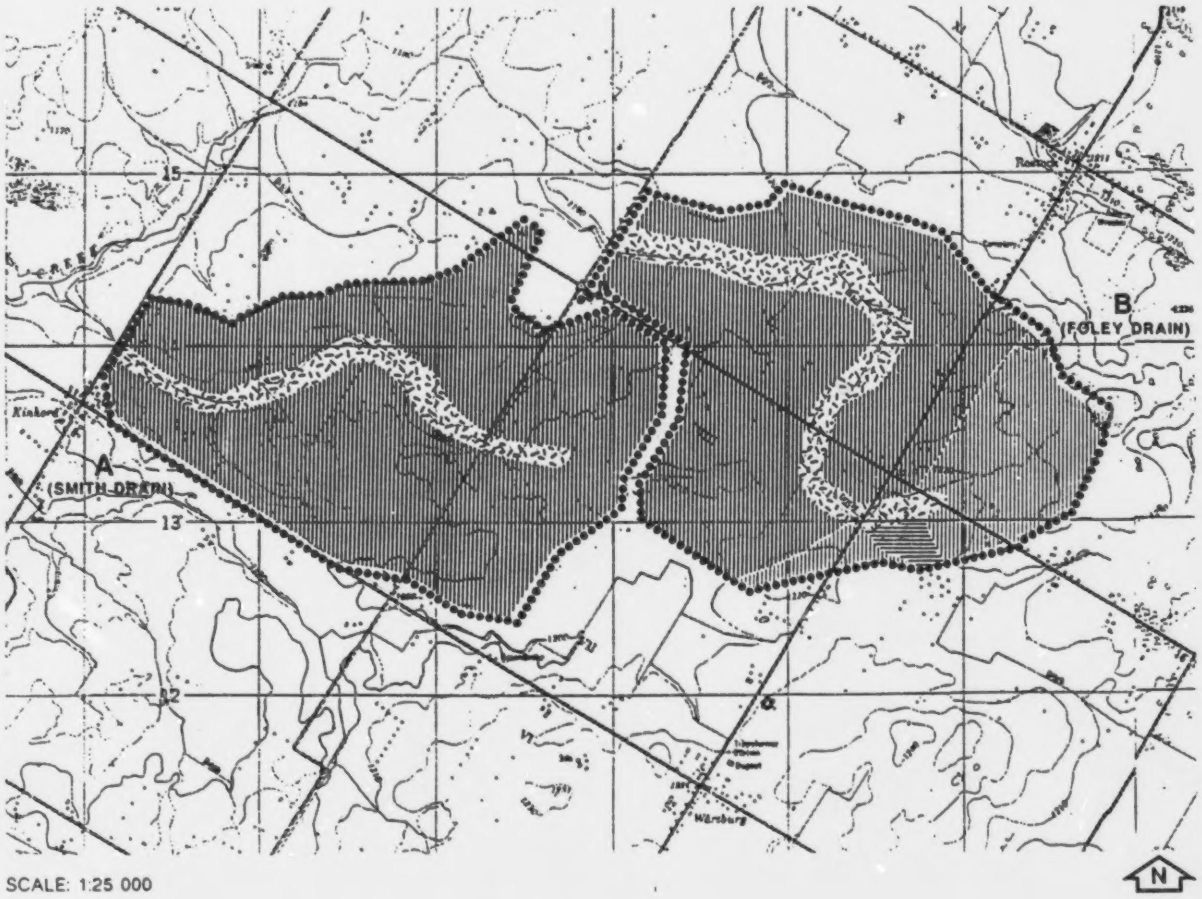

A
(FEWSTER DRAIN)
B
(NEWARK DRAIN)
C
D
H
B
M
V
P
SCALE: 1:25 000
N

Legend

- ·—·—· PROPERTY BOUNDARY
- C - CASH CROP
- D - DAIRY
- H - HOGS
- B - BEEF
- M - MARKET GARDEN
- V - VEAL
- P - POULTRY
- ○ HEADQUARTERS LOCATED ON PROPERTY
- □ HEADQUARTERS NOT LOCATED ON PROPERTY
- ○↘ OTHER LOCAL PROPERTY ASSOCIATED WITH HEADQUARTERS

CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT


15
13
12
A
(SMITH DRAIN)
B
(FOLEY DRAIN)
Kinkora
Wartburg
N

SCALE: 1:25 000

SWEEP

PILOT WATERSHED PROJECT

Canada Ontario

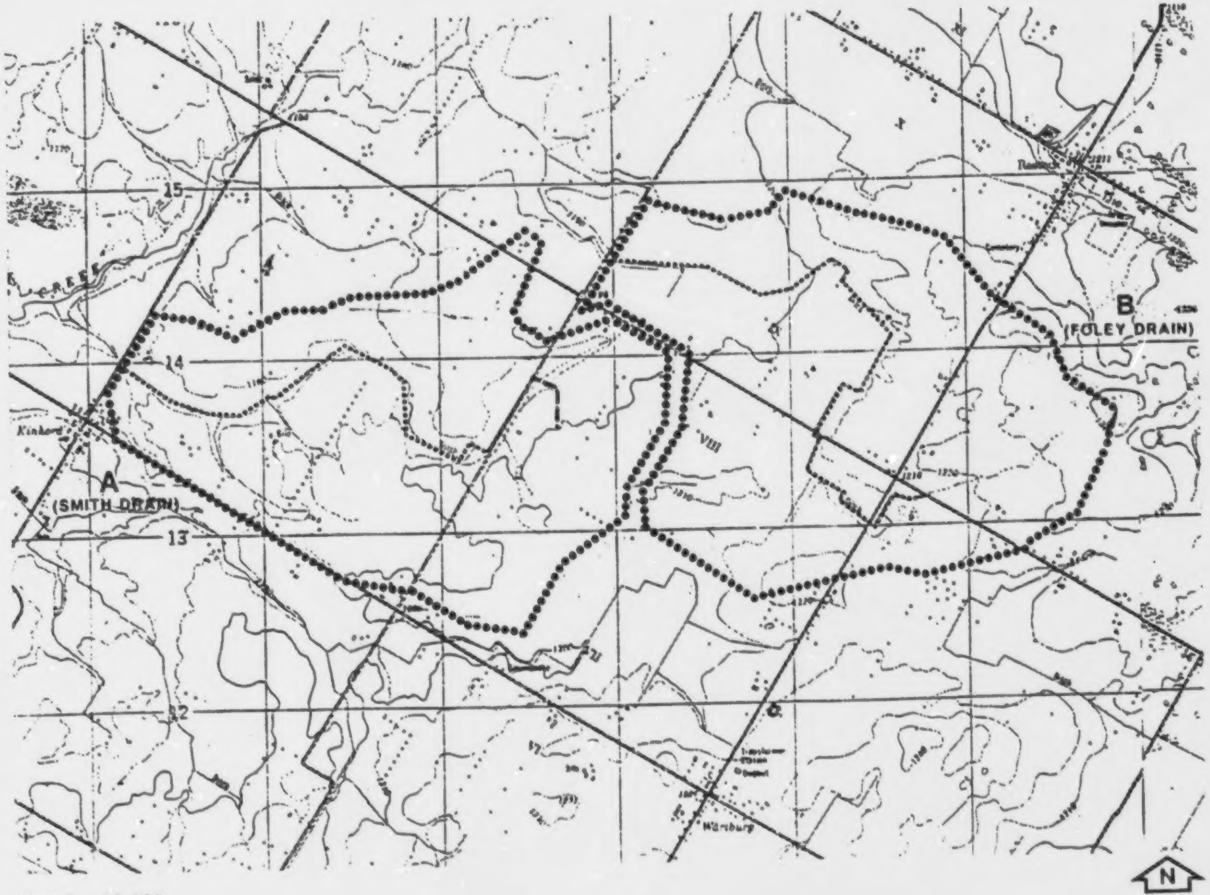
Legend

	SOIL TYPE	SURFACE TEXTURE	DRAINAGE
▥	HURON	SILT LOAM, CLAY LOAM	GOOD
▥	PERTH	CLAY LOAM, SILT LOAM	IMPERFECT
▤	BROOKSTON	SILT LOAM, CLAY LOAM	POOR
⁘	BOTTOMLAND	VARIABLE	POOR

CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED
WHIRL CREEK
SOILS


15
14
13
12
4
A
(SMITH DRAIN)
B
(FOLEY DRAIN)
CREEK
Kinkora
VIII
Wartburg
N

SCALE: 1:25 000

SWEEP

PILOT WATERSHED PROJECT

Canadä

Ontario

Legend

········ OPEN MUNICIPAL DRAIN

— — — COVERED MUNICIPAL DRAIN

CMS conservation management systems

CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

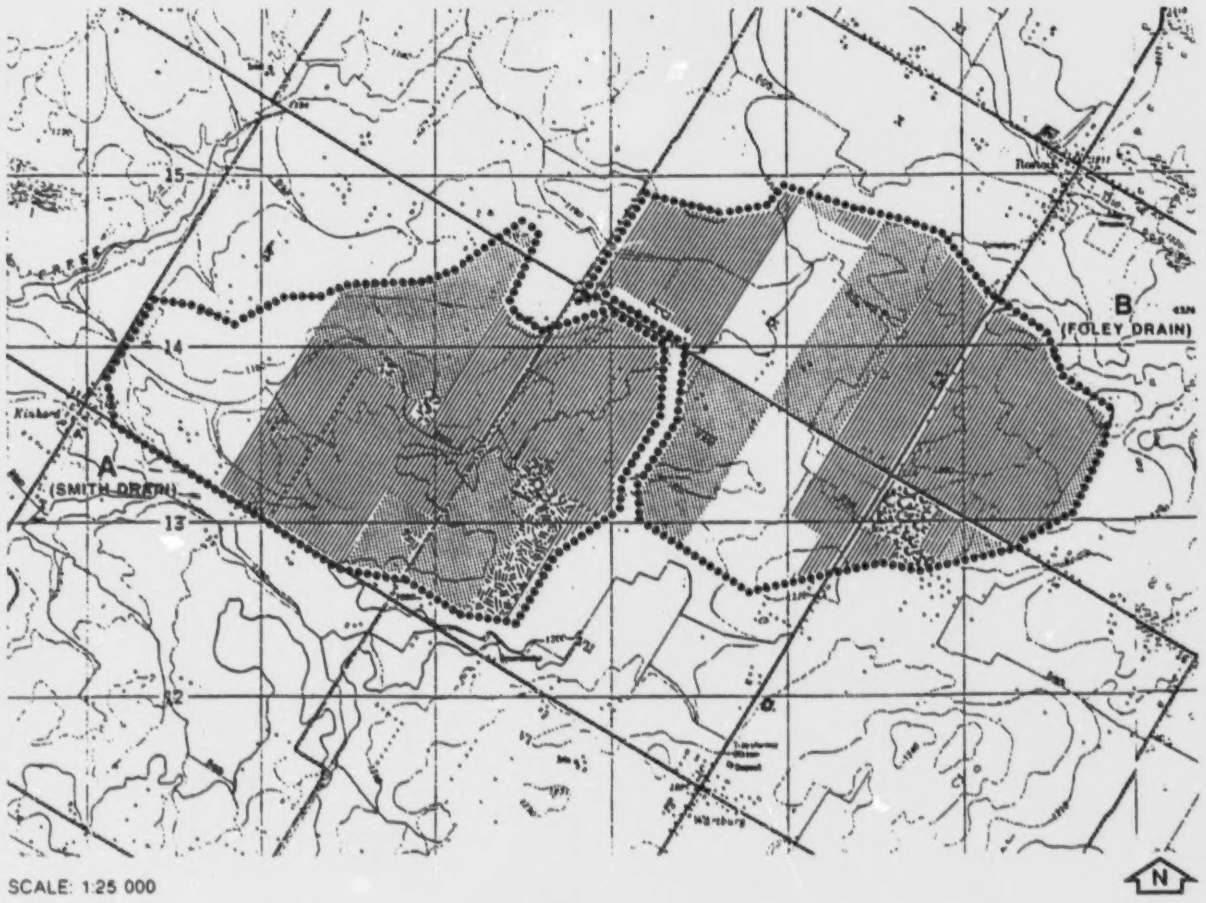
CANDIDATE SUB-WATERSHED

WHIRL CREEK

DRAINAGE

SWEEP
PILOT WATERSHED PROJECT

Canada Ontario

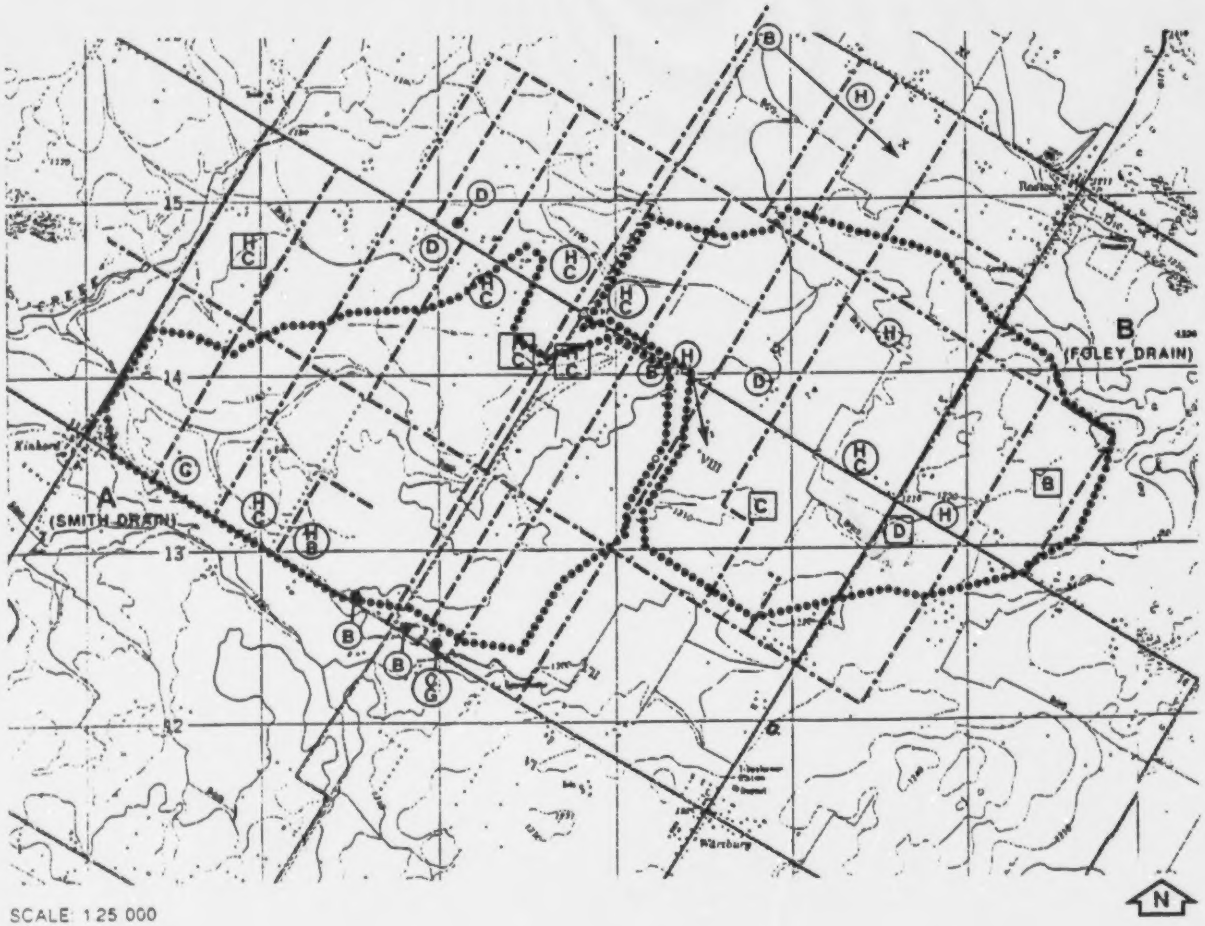

15
14
13
12
A
(SMITH DRAIN)
B
(FOLEY DRAIN)
SCALE: 1:25 000
N

Legend

- ▥ - CORN/GRAIN SYSTEMS
- ▒ - HAY ROTATION
- ░ - PASTURE
- ▓ - WOODLOT
- ☐ - NON-AGRICULTURAL OR USE UNKNOWN

CMS conservation management systems
CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED
WHIRL CREEK
LAND USE


15
14
13
12
A
(SMITH DRAIN)
B
(FOLEY DRAIN)
Kinkora
Rostock
Wartburg
VIII
H
C
D
B
G
N

SCALE: 1:25 000

SWEEP
PILOT WATERSHED PROJECT

Canada
Ontario

Legend

-·-·- PROPERTY BOUNDARY
C - CASH CROP
D - DAIRY
H - HOGS
B - BEEF
G - GREENHOUSE
○ HEADQUARTERS LOCATED ON PROPERTY
☐ HEADQUARTERS NOT LOCATED ON PROPERTY
○↘ OTHER LOCAL PROPERTY ASSOCIATED WITH HEADQUARTERS

CMS conservation management systems
CONSULTANTS IN SOIL CONSERVATION AND WATER MANAGEMENT

CANDIDATE SUB-WATERSHED
WHIRL CREEK
FARM SYSTEMS

Appendix B

Farm Operator Interview Forms

First Operator Interview Forms

PILOT WATERSHED PROGRAM DISCUSSION
WITH FARM OPERATORS

December 1987

DATE OF MEETING: ______________________________

NAME OF FARM OPERATOR: _________________________

ADDRESS: ____________________________________

____

PHONE NUMBER: ________________________________

INTERVIEWER: ________________________________

WATERSHED: __________________________________

SUB-BASIN: __________________________________

PURPOSE OF THE DISCUSSION

The time that we're together will serve several purposes:

A. First of all, it will provide you the opportunity to give us your general comments about what you heard at the public meeting regarding the Watershed Program; OR, if you were unable to attend the public meeting, we can give you some background information about the Program;

B. Second, you may have questions of clarification arising from the meeting or your own reading that you would like to ask;

C. Third, it will give us the opportunity to ask a few questions about your farm operation and your interest in the Watershed Program. This information will be useful to help us select the three pairs of drainage basins which will be included in the Pilot Watershed Program.

PILOT WATERSHED PROGRAM

1. We'd appreciate hearing any general comments you'd like to make regarding the Pilot Watershed Program, based on what you know about the Program to-date.

2. What questions come to mind when you think about the Program? I'll do my best to answer them, based on the information I have.

. I´d like to ask some questions about your farm, particularly about the land that you work within the drainage basin. The information requested in the following questions will give us a clearer picture of the farm types and farm practices found in this basin.

3. Where is you headquarter property? (Mark on map.)

4. a) How many acres do you farm?

Total acres _______________

ac. in basin _______________

b) How much do you rent?

Total acres _______________

ac. in basin _______________

c) For any rented parcels in the basin, how long have you had these and what is the arrangement with the owner?

d) Do you rent any of your basin land or buildings to other farmers? If yes, can you give us their name and phone number.

5. a) What are the main farming activities taking place in your farm operation? (Indicate the most important with No. 1)

Dairy ________

Beef ________

Swine ________

Poultry ________

Cash Crop ________________

Fruit or Vegetable (specify)

____

Other (specify)

____

b) If you raise livestock or poultry, please indicate each type and approximate number housed at any one time:

Land within basin		Land outside of basin	
Type	Number	Type	Number

6. What mix of crops do you grow on cropland in the basin and do you use a regular rotation for these?

7. On the map, please indicate woodlots, pasture areas, and areas that are tile drained. (Note if random or systematic.)

8. What are your main tillage operations? (eg. moldboard, disc plow, etc.)

Primary - ______________________________

____

Secondary - ______________________________

____

Other - ______________________________

The next questions will help us identify if soil conservation practices are being used or considered now.

9. Have you used tillage, planting or cropping practices which you would call "conservation" practices? (eg. red clover or rye cover crops, spring plowing, chisel plow or mulch tiller, etc.)

10. Do you have any erosion control structures on your farm such as drop inlets, tile outlet protection, rock chutes, grassed waterways and windbreaks? (Mark on map.)

11. Are you planning to try any (other) soil conservation measures on your farm?

12. a) Have you noticed any signs of erosion on your farm? (eg. sub-soil on knolls, lower yields, ditches and depressions filled with sediment, rills or gullying)

b) Has erosion been a problem on your farm?

c) Have you had any other ongoing soil problems such as compaction, low fertility, poor drainage or wet depressions?

13. Have you had any recent contacts with the Ministry of Agriculture and Food or the Conservation Authorities about soil erosion, manure management, drainage or other farm topics?

14. Do you or any members of your household belong to farm organizations that have promoted or discussed soil and water quality issues?

The watershed program will require cooperation between farmers. The following questions will help us decide how much cooperation can be expected.

15. Do you now share work or equipment with other family or non-family operators in the local area? If you do, how has it worked out?

16. Do people in this community usually respond when problems arise requiring community action?

17. Do groups and organizations with different interests tend to work together in this community.

In order for the Pilot Watershed Program to achieve its goals, we will need the interest and involvement of farm operators during the next three to four cropping seasons.

18. In general, what are the plans for your farm operation over this period? (i.e. continue farming, turn farm over to family member, etc.)

19. Are you planning any changes for the property in the drainage basin? (eg. new drains, stop using rented lands, new buildings or crops)

20. Given what you've learned about the Pilot Watershed Program would you be willing to go on to the next step of the program?

21. Do you have any comments or suggestions?

Second Operator Interview Forms

SWEEP - PILOT WATERSHED PROJECT

2nd Operator Interview

A. PROJECT CONTACT PERSON

Who will act as our main contact person for the project?

____

What mailing address should we use?

____
____
____
____

Telephone Number?

____

B. FARM LABOUR

Please list people working on this farm and fill out the information as indicated.

Name	Relationship to Cooperator	On-farm Duties	Weeks of Farm Work Per Year	Weeks of Off-Farm Work Per Year

Check off persons from the above list who should be invited to meetings and workshops for the project (not necessarily limited to one person).

List custom operators used for farm work.

Name of Operator	Operation

C. MACHINERY AND EQUIPMENT

Please describe the tractors used on this farm.

	Make	Model	HP	Age (Yrs)
1				
2				
3				
4				
5				

Other Field Machinery

Fill out table on next page for following machinery types:

TILLAGE IMPLEMENTS

eg. Moldboard Plough
- Chisel Plough
- Disc/Coulter Chisel Plough
- Tandem Disc
- S-tine Cultivator
- C-tine Cultivator
- Inter-row cultivator
- Harrows
- Packer
- Other

PLANTERS/DRILLS
- Row Crop Planter
- Drill
- Other

FERTILIZER/MANURE
- Applicators
- Manure Spreaders
- Spray Irrigation System

SPRAYER

HARVEST EQUIPMENT

eg. Combine
- Picker/Sheller (corn)
- Forage Harvester
- Cutter/Crimper
- Rake
- Baler
- Blower
- Puller

FIELD MACHINERY

Type	Make	Model	Age (yrs)	Working Width (ft)	Attachments
TILLAGE					
1.					
2.					
3.					
4.					
PLANTER/DRILL					
1.					
2.					
3.					
4.					
FERTILIZER/MANURE					
1.					
2.					
3.					
4.					
HARVEST					
1.					
2.					
3.					
4.					

Describe the type and capacity of crop dryers used on the farm:

Type	Capacity

Describe crop storage facilities used on this farm (silo, pit-silos, grain bins, corn cribs, etc.):

Type	Capacity

D. CROP MANAGEMENT

Crop Type					
Basin Acres/Year					

TILLAGE IMPLEMENT USED ON CROP

Fall	1.				
	2.				
Spring	1.				
	2.				
	3.				
	4.				
Inter-Row	1.				
	2.				

PLANTING

Row Spacing (in)				
Seed Variety				
Seeding Rate				
Equipment				
Attachments				
While Planting				
(ie. spray, etc.)				

Crop Type ____________ ____________ ____________ ____________

FERTILIZATION

Phosphorus/Potasium

type 1. ____________ ____________ ____________ ____________
2. ____________ ____________ ____________ ____________
analysis 1. ____________ ____________ ____________ ____________
2. ____________ ____________ ____________ ____________
rate/ac 1. ____________ ____________ ____________ ____________
2. ____________ ____________ ____________ ____________
application* 1. ____________ ____________ ____________ ____________
2. ____________ ____________ ____________ ____________

Nitrogen

type 1. ____________ ____________ ____________ ____________
2. ____________ ____________ ____________ ____________
analysis 1. ____________ ____________ ____________ ____________
2. ____________ ____________ ____________ ____________
rate/ac 1. ____________ ____________ ____________ ____________
2. ____________ ____________ ____________ ____________
application* 1. ____________ ____________ ____________ ____________
2. ____________ ____________ ____________ ____________

Other (__________________)

type 1. ____________ ____________ ____________ ____________
2. ____________ ____________ ____________ ____________
analysis 1. ____________ ____________ ____________ ____________
2. ____________ ____________ ____________ ____________
rate/ac 1. ____________ ____________ ____________ ____________
2. ____________ ____________ ____________ ____________
application* 1. ____________ ____________ ____________ ____________
2. ____________ ____________ ____________ ____________

* Application Methods

Broadcast (BR), Pop-up (PU), Band, (BA), Spray (SP), Knifed in (KI)

Crop Type	____	____	____	____

FERTILIZATION (Cont´d)

Manure				
type:				
liquid	____	____	____	____
semi-solid	____	____	____	____
solid	____	____	____	____
rate/ac	____	____	____	____
time applied				
spring	____	____	____	____
summer	____	____	____	____
fall	____	____	____	____
winter	____	____	____	____

Crop Type	______	______	______	______
WEED PROBLEMS				
types	______	______	______	______
	______	______	______	______
	______	______	______	______
	______	______	______	______
control	______	______	______	______
methods	______	______	______	______
	______	______	______	______
	______	______	______	______
	______	______	______	______
INSECT PROBLEMS				
types	______	______	______	______
	______	______	______	______
	______	______	______	______
	______	______	______	______
control	______	______	______	______
methods	______	______	______	______
	______	______	______	______
	______	______	______	______
	______	______	______	______
DISEASE PROBLEMS				
types	______	______	______	______
	______	______	______	______
	______	______	______	______
	______	______	______	______
control	______	______	______	______
methods	______	______	______	______
	______	______	______	______
	______	______	______	______
	______	______	______	______

Crop Type				
USE OF CROP				
Sold as				
grain				
forage				
other				
Fed as				
grain				
forage				
other				
NO. OF YEARS FIELD IS KEPT IN CROP				
CROP FOLLOWING IN ROTATION				

CROPS GROWN UNDER SPECIAL ARRANGEMENTS

Crops grown for seed companies, processors, etc.; or crops grown on research or demonstration plots on your farm; or share cropping crops:

Crop type	____________	____________
Contract Company	____________	____________
Plot Sponsor	____________	____________
Share Crop Partner	____________	____________
No. of Acres	____________	____________

Special Contract Requirements:

none	☐	☐
tillage	____________	____________
	____________	____________
	____________	____________
sprays	____________	____________
	____________	____________
	____________	____________
harvesting	____________	____________
	____________	____________
	____________	____________
other	____________	____________
	____________	____________
	____________	____________

E. LIVESTOCK PRODUCTION

Number of Animals Housed

Dairy Cows ________
Dairy Calves (less than 1 year) ________
Replacement Heifers (older than 1 year) ________
Beef Cows ________
Beef Calves (less than 1 year) ________
Replacement Heifers (older than 1 year) ________
Feeder Cattle ________
Bulls ________
Veal Calves ________
Sows ________
Boars ________
Replacement Gilts (young sows) ________
Pigs (less than 2 months) ________
Layer Hens ________
Chickens ________
Turkeys ________
Other (specify) ____________ ________

MANURE STORAGE

Type	Covered	Uncovered	Months of Available Storage	Runoff Overflow
1. Open Ground Storage				
2. Contained Ground or				
Concrete Pad				
3. Tank				
4. Earth Pit				

MILKHOUSE WASTE DISPOSAL

Method of Disposal ______________________________
____

PASTURE MANAGEMENT

Area of Pasture (ac) __________

Use of Pasture Primarily Feed ☐ Primarily Exercise ☐

First Month on Pasture __________
Last Month on Pasture __________

No. of Animals on Pasture ______________________________
____

Do Animals graze in corn of other fields after harvest?
____
____

F. FINANCIAL AND TECHNICAL ASSISTANCE PROGRAM PARTICIPATION

1. a) Have you applied for any assistance under the Land Stewardship Program? ____ Yes _____ No

   b) Does it involve you "SWEEP" land? _____ Yes _____ No

   c) If yes, please check the sections of the Program you have applied under, as well as the total amounts requested and approved. (Please check all that apply).

Section	Amount of Assistance Requested?		Amount Approved?
	(acres)	(dollars)	(dollars)
Soil Structure Improvement			
_____ Crop Rotation	_________	_________	_________
_____ Residue and Crop Cover	_________	_________	_________
_____ Tree Planting	_________	_________	_________
_____ Stewardship Lease	_________	_________	_________
Erosion Control Structures			
_____ Municipal Drain		_________	_________
_____ OSCEPAP Structure		_________	_________
Conservation Equipment			
_____ Equipment Rental		_________	_________
_____ Equipment Modification and Purchase		_________	_________
Conservation Technology			
_____ Conservation Training Courses		_________	_________
_____ On-Farm Conservation Equipment Instruction		_________	_________
_____ Municipal Drain		_________	_________
_____ Municipal Drain		_________	_________

2. a) Have you applied for any assistance under the OSCEPAP II Program since it began in April, 1986?

____ Yes _____ No

b) If yes, please check the sections of the Program you have applied under, as well as the amounts requested and approved?

	Amount of Assistance Requested (dollars)	Amount Approved (dollars)
Soil Conservation		
_____ Soil Erosion Control	_________	_________
_____ Protection of Highly Erodable Land	_________	_________
Environmental Protection		
_____ Manure Storage	_________	_________
_____ Milkhouse/Parlour Washwater Disposal System	_________	_________
_____ Pesticide-Handling Facilities	_________	_________

G. PLEASE MARK ON THE MAP

1. Total area to consider as a farm unit
2. Layout of fields, pasture and woodlots
3. Location of barn and manure storage
4. Location of milkhouse
5. Location of equipment storage
6. Laneways used on farm
7. Waterways, catch basins, drop inlets

H. LAND ACCESS

May project staff go on your land for soil sampling or other activities over the next few months?

Yes _____ No _____

If yes, do you want prior notice?

Yes _____ No _____

APPENDIX C

METEOROLOGICAL DATA

ESSEX - AVG. DAILY AIR TEMP. (C)

Annual data display: Summary for period ending 1991/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-4.7	-6.5	6.2	1.8	12.5	21.6	21.6	23.5	16.5	16.9	10.3	2.7
2	-3.4	1.7	7.8	0.2	10.1	18.9	22.8	21.3	18.8	20.6	0.7	-0.1
3	-8.4	3.2	-4.7	2.6	7.1	19.8	24.8	18.2	21.8	17.1	-4.5	-0.7
4	-8.4	5.4	-1.7	4.0	9.5	16.2	23.6	17.2	19.4	17.5	-4.5	-6.8
5	-4.4	3.3	0.8	0.1	10.7	18.0	24.2	16.4	18.9	14.4	-3.0	-7.6
6	-4.3	0.0	5.0	0.3	10.0	19.5	26.7	17.0	20.1	6.4	1.7	-3.8
7	-7.6	0.5	-1.9	1.1	10.4	18.9	27.4	19.4	22.0	7.5	-4.7	5.3
8	-6.2	1.3	-3.0	1.5	10.0	21.3	22.4	17.1	24.0	12.6	-4.8	9.7
9	-1.1	0.1	1.0	1.5	13.7	22.8	19.7	20.3	22.3	16.4	-1.8	3.4
10	-4.8	-1.4	-1.1	1.4	15.9	23.1	21.6	19.4	22.6	12.7	0.8	-0.1
11	-1.4	-6.4	-4.3	1.6	18.9	20.9	22.4	21.6	16.9	8.4	3.6	2.0
12	-3.5	-6.4	-5.8	1.8	23.1	20.3	20.5	21.6	17.7	8.2	1.9	5.0
13	-4.0	-2.1	-1.9	2.7	22.2	17.2	19.9	22.0	21.6	7.2	4.1	6.5
14	0.1	-2.8	0.0	3.1	23.5	21.9	20.3	22.2	21.5	10.4	7.1	0.5
15	0.7	-12.1	0.9	5.5	22.0	26.6	20.8	22.2	27.1	6.9	9.7	-5.5
16	0.1	-11.0	0.7	9.7	24.5	23.2	23.5	24.2	25.8	5.6	4.1	-9.0
17	-1.6	-2.7	2.2	7.9	16.9	22.5	25.5	22.6	18.4	11.3	2.3	-1.1
18	-2.4	-1.4	3.4	5.2	12.1	22.5	26.8	21.2	16.6	11.3	9.7	-7.0
19	1.0	4.0	5.7	6.5	14.5	24.1	27.6	19.1	11.3	5.1	13.9	-7.1
20	-1.1	0.2	4.8	3.1	15.4	25.2	28.7	17.0	8.8	5.1	10.6	-1.9
21	-10.7	3.8	10.5	2.7	19.6	24.5	26.4	18.8	10.6	9.6	6.2	0.0
22	-12.0	1.1	3.3	7.8	22.3	18.0	27.2	22.0	15.4	13.4	6.9	-1.6
23	-5.0	-7.2	9.3	9.1	24.2	19.0	25.8	20.5	13.5	17.6	5.8	0.2
24	-9.1	-0.3	4.3	9.1	23.7	20.0	21.3	20.1	10.1	16.9	-2.1	-1.8
25	-11.9	-3.6	4.6	10.5	23.4	22.5	20.6	21.9	10.6	16.9	-2.2	-1.4
26	-9.1	-5.9	6.6	13.4	22.7	25.2	16.3	24.4	9.7	16.7	-3.3	-1.6
27	-6.1	-5.3	14.1	15.3	23.2	25.6	16.4	24.8	8.2	12.3	2.0	0.7
28	-5.2	-1.7	5.9	15.4	24.9	26.5	18.2	25.9	8.5	9.7	3.4	-1.6
29	-4.2		-1.0	17.5	25.6	26.8	19.4	26.4	10.5	12.5	7.2	-0.6
30	-5.9		-2.2	18.4	24.7	22.1	18.3	25.8	16.7	12.1	10.3	-1.9
31	-8.4		1.8		23.9		19.6	20.2		9.9		-2.9
0 AVER	-4.9	-1.9	2.3	6.0	18.1	21.8	22.6	21.1	16.9	11.9	3.1	-0.9

AVER of monthly values 9.67178E+00

ESSEX - AVG. DAILY AIR TEMP. (C)

Annual data display: Summary for period ending 1992/ 6

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-3.1	-6.7	5.2	-1.6	13.9	15.6	0.0	0.0	0.0	0.0	0.0	0.0
2	0.4	-3.4	0.9	-2.9	18.5	16.2	0.0	0.0	0.0	0.0	0.0	0.0
3	3.4	-2.8	0.8	0.4	10.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0
4	2.2	-0.9	2.7	1.9	7.1	18.5	0.0	0.0	0.0	0.0	0.0	0.0
5	1.2	-5.8	4.4	2.3	6.2	18.3	0.0	0.0	0.0	0.0	0.0	0.0
6	0.3	-2.3	4.2	5.3	8.8	19.5	0.0	0.0	0.0	0.0	0.0	0.0
7	0.7	-1.1	9.0	9.2	10.9	19.6	0.0	0.0	0.0	0.0	0.0	0.0
8	-0.7	-7.9	8.1	5.0	13.5	16.8	0.0	0.0	0.0	0.0	0.0	0.0
9	3.5	-10.6	8.8	6.3	13.2	15.8	0.0	0.0	0.0	0.0	0.0	0.0
10	0.2	-4.8	-2.4	4.4	14.4	17.0	0.0	0.0	0.0	0.0	0.0	0.0
11	-1.2	-3.8	-9.7	10.0	18.1	19.2	0.0	0.0	0.0	0.0	0.0	0.0
12	0.8	-11.3	-9.4	2.5	20.9	21.4	0.0	0.0	0.0	0.0	0.0	0.0
13	2.7	-3.8	-6.9	-1.0	15.2	23.3	0.0	0.0	0.0	0.0	0.0	0.0
14	-6.7	-0.3	-5.7	2.5	9.5	20.5	0.0	0.0	0.0	0.0	0.0	0.0
15	-9.7	1.7	-7.3	3.3	13.3	16.9	0.0	0.0	0.0	0.0	0.0	0.0
16	-15.7	0.7	-3.8	9.6	16.5	18.3	0.0	0.0	0.0	0.0	0.0	0.0
17	-6.4	0.7	1.1	5.0	21.2	23.8	0.0	0.0	0.0	0.0	0.0	0.0
18	-14.3	1.6	-3.1	4.4	10.8	21.1	0.0	0.0	0.0	0.0	0.0	0.0
19	-15.0	3.0	-1.4	9.7	13.7	14.2	0.0	0.0	0.0	0.0	0.0	0.0
20	-8.4	1.0	-1.9	15.3	18.1	9.1	0.0	0.0	0.0	0.0	0.0	0.0
21	-4.0	0.1	-3.5	15.2	19.4	9.4	0.0	0.0	0.0	0.0	0.0	0.0
22	-1.8	1.3	-4.4	8.7	21.6	13.6	0.0	0.0	0.0	0.0	0.0	0.0
23	2.0	1.4	-5.0	9.2	16.6	14.4	0.0	0.0	0.0	0.0	0.0	0.0
24	-6.8	-0.3	-0.8	7.1	6.3	14.8	0.0	0.0	0.0	0.0	0.0	0.0
25	-9.5	1.4	3.5	5.1	8.0	15.8	0.0	0.0	0.0	0.0	0.0	0.0
26	-6.9	0.2	4.6	7.4	9.1	17.5	0.0	0.0	0.0	0.0	0.0	0.0
27	-3.8	2.7	2.5	6.5	11.9	16.6	0.0	0.0	0.0	0.0	0.0	0.0
28	-1.3	1.1	0.0	6.7	13.7	18.1	0.0	0.0	0.0	0.0	0.0	0.0
29	-2.0	-5.7	1.7	9.0	15.1	21.3	0.0	0.0	0.0	0.0	0.0	0.0
30	-0.2		1.7	9.2	12.7	19.3	0.0	0.0	0.0	0.0	0.0	0.0
31	-0.7		3.1		13.4		0.0	0.0		0.0		0.0
0 AVER	-3.2	-1.9	-0.1	5.9	13.6	17.5	0.0	0.0	0.0	0.0	0.0	0.0

AVER of monthly values 2.64285E+00

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                        ESSEX -  AVG. DAILY AIR TEMP. (C)

                      Annual data display: Summary for period ending 1989/12

Day          JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

  1         -2.5     2.9    -4.4     1.7     7.1    21.1    20.2    21.7    21.0    16.2     6.0    -0.7
  2          2.1    -4.3    -6.1     5.5     6.9    20.5    23.1    23.5    17.7    18.0     5.0     0.8
  3         -0.7    -4.6    -3.1     6.7     7.3    18.3    22.6    25.3    16.4     9.0     0.5    -7.7
  4         -8.6    -6.9     3.6     9.4    11.5    16.9    22.8    25.2    18.5     6.8     3.2    -6.6
  5         -3.4    -7.4    -1.3     5.3    12.4    15.5    23.1    25.6    21.7    10.5    10.0    -2.5

  6         -1.0    -8.9    -6.0     3.2     4.1    18.9    24.7    20.7    22.1    12.6     8.2    -1.7
  7          3.5    -9.3    -9.5     2.6     4.6    21.8    24.6    14.7    21.7     7.3     4.5    -8.0
  8         -1.3    -7.7    -2.3     2.6     9.3    22.5    22.9    15.3    24.3     5.7     6.6    -7.3
  9         -8.2   -11.8    -0.4    -1.5    10.6    20.3    25.2    20.3    24.0     3.8     5.1    -5.4
 10         -0.7    -6.5     0.3    -2.5     8.6    15.4    28.4    20.7    18.8    10.1     4.2    -1.5

 11         -1.9    -2.3     4.3    -0.1     7.3    16.4    23.1    20.9    18.3    11.2     6.1    -4.4
 12          3.2    -1.4    -2.2     2.9     7.6    15.6    17.9    20.5    18.7    15.7     1.4    -7.6
 13         -2.4     0.7    -1.3     2.6     8.3    16.1    19.2    21.1    14.0    14.1    10.6    -9.4
 14         -2.0     3.2     6.0     7.4     9.5    16.2    18.5    22.1    13.1    18.3    13.3    -9.5
 15          0.6     1.2     3.1     7.5    10.4    16.4    17.9    21.5    13.8    18.6    11.9   -13.0

 16          0.7    -4.6     0.5     9.4    13.8    15.7    19.9    18.4    14.0    16.5    -0.4   -12.9
 17          3.2    -5.0     0.3     9.6    17.1    17.0    21.5    17.7    16.5     6.4    -3.4   -16.6
 18          4.8    -5.6    -3.3     2.0    17.8    19.5    23.4    18.0    15.6     4.4    -3.8   -13.9
 19          3.8     0.0    -4.6     5.8    16.8    19.4    21.4    19.2    16.1     2.8    -0.2   -10.2
 20         -0.9    -0.2    -1.2     9.1    17.0    18.8    19.5    20.7    16.3     2.6     6.1   -14.0

 21         -6.1     0.8    -4.3     7.2    16.7    18.5    21.8    22.6    18.0     4.2    -3.2   -17.2
 22          0.9    -2.4    -3.1     3.9    17.4    21.4    23.8    22.0    19.7     6.1    -4.2   -18.9
 23          3.9    -9.0     0.4     3.3    13.4    23.5    24.5    20.5     8.0    10.3    -5.2   -16.4
 24          5.0    -9.3     3.3     6.7    15.3    24.3    25.6    18.1     6.6    14.4    -1.9   -15.4
 25          1.6    -1.0     7.4     9.0    19.3    22.5    26.2    17.4    10.1    14.5     4.2    -8.5

 26          4.8     1.5     3.7    11.0    20.8    24.9    25.4    18.3    10.6    13.6     4.0   -11.7
 27          1.9    -2.0    14.1     9.3    14.1    22.6    24.4    21.8     7.6    12.8     6.7    -8.8
 28          4.6    -1.5    15.6     6.6    12.3    18.8    19.6    21.7    11.3    13.0     2.2    -6.3
 29          4.5             3.8     7.3    17.2    15.4    18.7    22.8    15.1    13.2    -4.7    -2.3
 30          5.1             2.7    10.6    22.1    17.4    18.3    20.4    13.1    13.2    -0.4    -3.5
 31          7.9             0.9            21.3            20.4    21.5            10.1             1.2
0 AVER       0.7    -3.6     0.6     5.5    12.8    19.1    22.2    20.6    16.1    10.8     3.1    -8.4

AVER of monthly values  8.28917E+00
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                        ESSEX -  AVG. DAILY AIR TEMP. (C)

                      Annual data display: Summary for period ending 1990/12

Day          JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

  1         -1.8     2.9    -1.6     5.5    11.4    18.9    18.7    17.7    23.1    11.9    13.7     4.4
  2         -1.3    -2.6     2.0     3.9     8.9    21.5    20.2    20.3    21.7    12.5    15.4     1.6
  3          1.7    -2.4    -3.7    -0.8     9.8    18.4    23.7    21.4    17.7    17.7    15.1     3.8
  4          3.5    -2.8    -6.7     4.5     7.4    10.4    29.1    20.3    19.9    15.1     9.3    -2.5
  5         -1.5    -1.0    -5.9     1.5     9.4    13.1    22.4    21.0    21.9    18.2     7.8    -2.3

  6         -2.2     1.8    -7.6    -0.9    10.4    19.3    17.0    16.9    22.0    21.0     3.3     0.8
  7          0.4     4.3    -6.9    -1.8    15.0    18.9    17.8    17.3    19.1    17.1     2.7    -1.1
  8          1.1     6.5    -2.7     3.4    18.5    20.3    24.9    18.2    16.4    11.2     1.3     0.8
  9          2.6     8.1     4.9     8.9    19.5    21.8    25.2    20.4    19.5     9.3     3.6     3.0
 10          0.9     0.9     5.9     4.9     9.5    16.7    22.6    21.1    20.6    11.4     4.4     2.0

 11          1.2    -1.1     4.7     1.4     8.7    17.9    17.5    20.6    18.9     8.5     1.2     1.3
 12         -3.7    -0.9    15.8    -1.3     8.9    17.6    19.3    19.3    20.1     8.4     0.9     6.6
 13         -5.0     6.1    15.2     3.6    10.2    23.5    18.0    18.9    20.6     9.7     0.0     1.2
 14         -1.4    -3.7    15.1     5.8    11.1    22.7    18.3    18.3    19.6    12.0     4.3    -3.3
 15          2.7    -2.2    16.5     5.6    16.3    20.3    19.7    20.5    12.4    11.5    12.0     1.1

 16          4.0    -0.4     9.6     6.9    17.6    21.5    21.3    22.6    11.9    11.7    10.4     1.2
 17          9.2    -6.6     7.4     1.9    14.2    26.9    24.1    22.9     9.6    18.5     3.1     1.4
 18          2.0    -2.1     1.7     2.8    11.4    25.6    23.3    22.5    10.8     9.6     0.8     2.8
 19         -2.6    -2.0    -1.6     8.5    10.5    16.5    24.5    18.4    13.5     5.2     2.8     0.0
 20         -1.5    -5.8    -1.5    11.7    14.6    18.5    21.4    17.4    14.2     8.2     4.8     1.3

 21         -0.5     0.4     2.2     9.9     9.8    23.0    21.7    18.6    14.8    13.1     8.4     6.4
 22          0.7     3.2     7.2     9.7    11.6    20.2    17.1    18.9    13.6     8.7     9.6     6.3
 23          0.5    -0.7    -0.1    13.7    13.3    15.7    19.9    20.0     8.7     7.5     4.4    -5.8
 24          4.4    -4.9    -3.2    17.7    13.9    15.7    20.6    20.5    10.5     9.4     2.9   -12.8
 25          2.5   -13.0    -0.2    22.1    13.9    17.8    21.8    21.1    15.8     4.9     6.5    -9.0

 26         -2.0    -9.1    -1.3    21.1    15.9    21.1    21.7    23.9    15.4     3.6     5.6   -13.1
 27          3.8     0.4    -0.9    21.0    17.0    20.4    22.4    25.7    15.9     8.5    16.0    -9.2
 28         -1.2    -4.4     2.3    19.8    16.8    17.2    23.6    24.3    18.2     4.8     8.4    -1.4
 29         -1.9             3.5    15.1    12.5    23.3    24.5    20.5    15.0     4.2     0.7     5.7
 30         -3.4             4.9    15.8    12.4    22.9    22.4    19.0    13.0    10.9     1.7    -1.3
 31         -1.6             3.8            16.0            17.3    19.9            11.3            -8.9
0 AVER       0.3    -1.1     2.5     8.1    12.8    19.6    21.4    20.3    16.5    10.8     6.0    -0.6

AVER of monthly values  9.71081E+00
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                      ESSEX -  MAX. DAILY AIR TEMP. (C)

                  Annual data display: Summary for period ending 1989/12

 Day       JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

   1       4.2      9.1      1.9      5.3      9.1     24.8     26.5     26.3     24.3     21.0      9.2      2.1
   2       9.3     -0.8     -1.7      9.0     12.1     24.7     28.8     29.2     21.7     23.0      7.7      4.0
   3       6.6     -1.4      1.7      9.9     12.5     22.9     24.8     30.5     21.5     12.3      3.0     -3.6
   4      -1.5     -1.1      7.1     14.1     16.5     21.0     26.6     28.0     23.4     14.2      6.0     -2.5
   5       2.4     -0.6      6.4      6.9     16.2     19.3     27.7     30.4     25.4     16.4     13.9      0.3

   6       0.5     -5.7     -3.4      6.1      8.2     24.5     29.4     24.8     25.3     15.2     13.5      2.8
   7      12.3     -7.6     -5.7      5.6      8.2     27.7     30.9     18.6     25.4     10.3      6.0     -5.4
   8      12.1     -0.7      0.4      5.4     14.4     27.0     29.1     21.2     28.8      9.4      8.5     -4.9
   9      -5.8     -6.8      4.3      1.0     13.5     24.6     29.8     25.0     29.2      9.6      7.6     -1.9
  10       3.0     -4.1      5.3      1.5     13.4     18.6     33.7     26.4     21.6     12.7      6.5      1.3

  11       2.2      0.5     13.0      4.1     10.5     21.6     27.8     26.7     22.6     16.1      9.7     -2.9
  12       6.3      2.0      0.9      4.7      9.6     19.2     20.4     26.2     23.9     21.9      4.9     -5.2
  13       0.1      3.7      4.3      7.7     10.0     18.4     24.1     27.1     15.5     21.4     18.5     -6.0
  14       1.8      6.7     13.8     14.0     12.1     18.8     23.9     27.2     13.6     26.8     16.5     -6.7
  15       6.4      2.6     13.4     11.3     15.0     19.2     22.8     25.6     18.5     26.2     15.7    -10.2

  16       5.0     -0.1      6.9     15.9     19.6     18.0     25.8     22.4     15.2     24.1      3.6     -8.1
  17       6.3     -2.3      3.0     15.0     24.7     21.7     27.4     24.2     22.2      9.6      0.1    -13.3
  18       7.6     -3.7     -0.9      3.1     23.6     23.9     29.0     23.4     21.5      6.4      0.2    -10.3
  19       6.5      3.6     -1.8     12.9     20.9     24.5     24.5     22.9     21.6      6.0      5.2     -8.6
  20       4.9      0.7      0.0     15.9     20.3     21.9     20.1     24.3     22.5      3.8     13.1     -9.3

  21      -2.3      1.9     -1.9     11.8     23.4     21.7     25.4     28.0     24.6      6.4     -1.6    -14.3
  22       5.9      0.7     -0.2      8.0     23.3     26.9     29.4     26.8     22.1     13.1     -3.0    -12.3
  23       8.5     -6.4      5.3      8.2     16.4     28.9     28.7     22.7     10.9     16.0     -2.5    -11.8
  24       7.3     -6.2      9.3     13.3     22.2     30.7     30.1     22.8     12.8     20.2      2.3    -10.6
  25       6.0      2.5     17.2     14.1     26.2     27.9     31.3     22.9     16.0     20.8      6.7     -4.3

  26       8.4      5.6      9.5     17.1     25.8     31.5     31.0     24.8     14.6     20.9      9.2     -3.8
  27       5.2     -0.5     23.0     13.6     17.1     26.1     28.4     28.4     13.4     20.8     13.9     -5.7
  28       9.5      3.2     19.1      8.4     17.4     24.4     21.9     26.6     18.3     21.1     12.9     -3.3
  29       6.3               12.4     10.7     22.6     19.8     23.4     25.5     21.3     19.6     -3.1     -0.8
  30       7.4                5.6     16.9     26.9     23.6     20.4     25.8     18.6     20.1      2.8      1.0
  31      14.0                1.6              27.0              25.2     27.0              13.6               3.4
MAX       14.0      9.1     23.0     17.1     27.0     31.5     33.7     30.5     29.2     26.8     18.5      4.0

MAX  of monthly values  3.36800E+01
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                      ESSEX -  MAX. DAILY AIR TEMP. (C)

                  Annual data display: Summary for period ending 1990/12

 Day       JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

   1      -1.1      5.1      2.7      7.8     16.4     24.2     21.1     23.7     27.5     17.0     20.4      5.7
   2       1.0     -0.4      6.4      6.2     13.9     25.7     25.3     25.5     26.0     18.8     19.5      3.2
   3       4.1     -1.1     -0.6      0.1     13.4     24.6     28.4     26.4     21.4     22.4     19.9      9.6
   4       7.3     -2.3     -5.6     10.1      8.6     13.8     35.3     23.5     25.7     21.8     14.1      1.4
   5      -0.2      2.4     -5.1      4.8     14.1     16.6     27.2     23.8     24.5     25.1     13.3      0.6

   6       0.5      3.9     -3.3      2.2     14.0     23.7     19.6     19.1     29.8     26.9      4.8      2.1
   7       4.7      8.3     -2.4      1.2     21.6     23.2     21.8     22.4     22.8     19.9      4.4      1.0
   8       4.4     10.4      0.6      9.7     24.0     24.3     31.1     23.7     21.3     11.8      4.8      4.7
   9       4.3     10.1      9.7     14.3     23.3     26.5     29.0     26.0     24.5     10.4      5.4      7.5
  10       1.9      3.8     11.4      7.5     17.8     19.7     26.3     27.2     25.2     18.6      7.7      4.8

  11       4.6      0.9      9.7      4.6     14.6     22.3     19.1     26.3     23.5     13.2      3.9      4.1
  12      -1.6      3.8     20.2      1.9     10.9     20.0     22.5     25.6     26.0     10.7      4.0     10.6
  13      -2.9     14.8     18.8      8.1     13.7     30.0     20.4     22.9     25.5     14.8      3.4      8.7
  14       1.3     -2.4     21.3      9.1     15.3     25.5     21.0     23.0     23.7     17.4      9.7     -0.2
  15       5.8     -1.0     21.4     10.3     20.6     25.9     22.6     25.0     14.9     15.6     18.0      3.8

  16       7.6      2.0     12.1     12.1     20.4     28.5     25.8     27.0     14.9     15.5     13.3      2.8
  17      11.1     -2.9      9.3      8.0     17.6     32.0     28.6     26.6     14.0     22.9      5.7      3.8
  18      10.0      2.3      4.2      8.9     14.6     28.9     29.7     25.4     15.7     19.8      4.2      5.9
  19      -1.4      0.3     -0.3     14.4     13.8     21.5     29.6     20.8     16.7      8.8      7.4      1.6
  20      -0.5     -2.7      3.6     14.7     21.6     22.1     23.1     18.6     19.4     12.7     11.4      4.1

  21       1.1      5.8      5.6     14.3     12.3     28.1     25.8     20.0     18.7     18.4     13.1      8.5
  22       1.7      5.4     11.3     16.4     16.1     22.2     18.7     20.1     18.0     11.7     14.1     10.4
  23       5.3      0.7      5.4     19.8     17.7     17.2     24.1     22.2     10.9     11.9      6.9     -1.5
  24       6.7     -1.4     -0.8     25.9     17.3     21.2     25.5     25.1     14.8     15.4      7.1     -9.1
  25       8.6    -10.7      5.0     28.6     18.8     24.9     26.8     25.7     21.2      7.8      8.7     -5.6

  26      -0.6     -3.6      0.4     27.2     20.3     26.5     26.8     28.1     20.7      8.1     12.4     -8.1
  27       8.8      3.4      3.8     27.4     22.5     25.0     28.6     30.2     22.5     13.3     18.2     -2.8
  28       2.0     -1.5      7.3     26.5     22.6     18.2     29.9     32.0     25.0      7.4     17.3      0.8
  29      -0.5                7.0     19.2     15.0     27.6     28.9     24.2     18.4      7.4      2.2      9.1
  30      -0.3                8.2     21.0     16.9     29.8     25.9     23.1     17.4     17.9      5.2      2.9
  31       1.2                5.7              22.1              20.0     24.6              17.2              -6.4
0 MAX     11.1     14.8     21.4     28.6     24.0     32.0     35.3     32.0     29.8     26.9     20.4     10.6

MAX  of monthly values  3.52800E+01
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ESSEX - MAX. DAILY AIR TEMP. (C)

Annual data display: Summary for period ending 1991/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-1.8	-1.1	10.7	4.0	15.5	24.4	25.3	27.3	21.0	20.0	14.3	3.7
2	-1.6	4.8	13.2	5.0	14.4	22.2	27.4	26.4	26.3	26.4	6.4	1.1
3	-6.3	7.2	-3.0	8.4	10.3	26.1	29.9	21.7	28.9	21.4	-2.9	1.8
4	-4.7	10.2	3.9	17.2	15.4	19.7	28.0	21.7	24.2	20.8	-2.3	-2.8
5	-2.2	7.2	4.8	0.2	15.6	23.2	28.7	21.3	23.5	21.0	1.8	1.0
6	-2.8	1.6	8.9	0.6	14.3	25.3	31.7	24.2	26.1	8.1	4.0	1.0
7	-5.1	1.0	0.3	1.5	15.7	23.9	32.8	26.0	27.1	12.4	-1.6	8.2
8	-0.4	4.7	0.6	1.8	13.9	27.5	25.6	22.9	30.0	18.9	-0.6	12.5
9	0.0	2.2	4.6	3.0	21.9	28.6	25.0	25.3	24.2	20.5	2.8	12.1
10	-3.0	1.3	1.4	1.6	22.0	29.1	26.4	25.1	26.0	16.4	4.8	1.4
11	0.9	-5.0	-1.7	1.8	26.3	23.2	26.0	27.9	20.1	10.4	8.5	4.8
12	-0.3	-2.4	-3.0	1.9	29.6	26.1	24.0	27.6	21.4	11.2	3.1	12.0
13	-1.4	-0.9	1.9	9.2	30.7	22.8	21.9	27.5	26.0	10.3	7.4	12.1
14	1.3	-1.7	3.4	6.7	29.4	28.6	25.0	27.5	24.6	14.5	10.9	4.0
15	3.3	-6.9	5.4	10.3	28.3	32.9	27.5	28.4	32.4	10.1	11.2	-2.8
16	0.9	-4.9	7.3	14.3	31.7	26.6	29.4	29.7	29.0	10.6	7.5	-3.9
17	0.3	-0.5	8.2	11.2	25.2	26.8	30.5	27.5	21.9	16.8	6.1	1.1
18	0.3	2.6	4.4	8.9	16.4	28.0	31.7	26.3	21.5	14.5	13.7	-4.5
19	3.6	6.2	10.9	8.1	21.4	29.4	32.3	20.3	14.7	7.8	15.7	-3.3
20	2.4	2.1	10.3	5.4	21.0	30.5	33.4	19.1	12.9	9.8	15.5	1.0
21	-7.9	8.1	19.7	3.2	26.8	30.8	30.0	24.5	15.7	14.5	7.0	2.2
22	-9.0	4.1	4.7	13.9	29.1	22.7	32.9	28.0	20.7	19.8	8.4	-0.1
23	-0.6	-4.8	15.8	14.1	30.9	24.0	29.4	25.0	17.0	22.7	9.6	2.4
24	-7.1	4.3	7.0	13.6	27.4	25.7	26.8	24.6	13.5	18.6	-0.7	2.0
25	-8.5	-2.2	8.6	15.7	27.2	27.2	25.9	29.4	15.9	17.9	-1.0	1.2
26	-6.6	-4.8	10.4	18.8	25.1	29.9	22.1	29.2	12.7	18.4	-1.4	0.3
27	-2.3	-2.5	17.0	21.9	26.2	30.3	23.3	29.7	12.9	17.6	4.1	2.4
28	-1.4	2.4	11.0	21.5	29.2	30.9	24.2	31.0	14.4	11.3	4.8	0.1
29	-1.0		3.1	21.8	30.7	31.0	23.3	31.9	15.5	14.4	12.9	0.3
30	-3.8		0.9	21.1	30.4	25.0	21.7	32.2	26.0	14.9	14.6	-0.4
31	-4.9		6.0		29.1		24.6	22.8		11.6		-1.9
MAX	3.6	10.2	19.7	21.9	31.7	32.9	33.4	32.2	32.4	26.4	15.7	12.5

MAX of monthly values 3.33800E+01

ESSEX - MAX. DAILY AIR TEMP. (C)

Annual data display: Summary for period ending 1992/ 6

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-2.5	-3.7	14.2	0.9	23.5	20.8	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
2	3.2	0.6	2.3	-1.0	24.5	22.4	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
3	5.8	0.3	4.1	4.5	14.6	24.5	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
4	3.5	2.1	9.8	4.5	9.4	23.0	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
5	2.6	-2.9	8.9	7.2	9.8	21.4	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
6	0.9	2.8	5.7	10.9	13.4	24.2	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
7	1.6	0.3	12.1	16.4	16.8	22.4	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
8	1.6	-5.8	9.9	10.4	20.1	21.2	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
9	5.4	-7.4	12.6	10.3	17.4	19.5	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
10	1.8	2.0	12.0	7.2	20.4	23.1	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
11	0.3	2.0	-7.4	18.9	25.1	24.7	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
12	4.1	-7.8	-5.5	5.0	27.6	29.0	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
13	4.1	-0.8	-3.7	0.9	19.6	29.3	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
14	-0.6	1.0	-1.9	5.7	13.5	24.9	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
15	-7.0	4.7	-4.3	6.4	19.9	20.9	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
16	-11.0	4.4	1.7	20.1	23.1	24.3	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
17	-3.4	1.8	6.2	6.2	28.3	31.2	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
18	-10.8	5.0	-1.2	5.5	14.5	27.1	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
19	-9.0	5.0	1.6	15.2	20.9	18.5	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
20	-6.1	2.5	2.9	22.2	25.0	10.6	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
21	0.9	3.6	-1.1	18.5	25.9	13.6	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
22	2.7	4.1	-2.5	11.8	28.5	19.0	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
23	3.6	3.6	-0.4	15.9	25.8	17.4	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
24	-3.2	0.9	3.8	9.4	8.7	17.8	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
25	-6.8	3.1	4.8	6.2	11.3	20.3	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
26	-4.2	2.2	8.3	10.7	11.9	22.9	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
27	-1.0	6.8	5.6	9.8	17.3	21.1	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
28	0.8	4.3	4.2	11.9	19.0	23.6	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
29	-0.9	-2.0	5.8	11.8	20.0	27.1	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
30	1.2		4.2	12.8	13.8	24.7	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••
31	0.8		9.6		16.8		••••••••	••••••••		••••••••		••••••••
0 MAX	5.8	6.8	14.2	22.2	28.5	31.2	••••••••	••••••••	••••••••	••••••••	••••••••	••••••••

MAX of monthly values 3.11700E+01

ESSEX - MIN. DAILY AIR TEMP. (C)

Annual data display: Summary for period ending 1989/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-5.7	-2.7	-8.8	-2.3	4.9	18.5	11.6	15.0	17.8	10.9	2.8	-2.0
2	-5.2	-5.4	-10.6	3.1	3.7	17.0	17.4	18.1	12.3	11.3	1.4	-3.1
3	-5.6	-7.4	-7.1	4.9	1.8	14.1	19.8	19.6	10.6	4.2	-1.8	-9.4
4	-12.3	-9.9	-1.4	6.1	5.5	12.1	20.1	22.5	11.6	-0.3	-1.4	-11.1
5	-8.9	-10.3	-5.1	3.2	8.6	12.4	18.2	21.0	18.8	2.7	4.4	-8.6
6	-2.1	-11.3	-9.7	-0.5	1.6	12.4	19.3	14.2	20.1	7.4	3.4	-7.8
7	-1.4	-11.2	-12.7	0.3	1.0	16.8	17.3	10.1	19.5	3.2	2.5	-11.6
8	-7.7	-11.2	-9.1	-0.7	3.2	17.6	15.4	9.1	20.2	0.9	3.4	-9.7
9	-9.9	-15.8	-6.2	-4.8	7.5	16.3	19.0	15.7	21.1	-2.4	3.3	-10.5
10	-5.6	-10.2	-3.8	-7.2	5.3	13.1	22.2	15.6	16.0	6.8	1.9	-3.7
11	-6.1	-5.3	-2.2	-4.2	4.6	9.2	19.3	15.5	14.3	4.8	1.4	-7.4
12	-2.3	-4.6	-6.5	0.7	6.4	13.9	14.8	14.9	13.9	9.8	-1.5	-11.3
13	-5.0	-2.0	-6.3	-2.0	6.8	14.1	13.7	14.7	12.6	7.3	0.4	-12.5
14	-6.3	0.7	-1.5	1.3	7.8	14.2	13.5	16.3	12.5	11.4	11.6	-15.7
15	-1.1	0.0	-3.0	4.2	4.0	14.7	11.9	17.6	8.9	11.6	4.4	-17.3
16	-3.2	-7.1	-5.6	2.7	9.3	12.6	12.3	14.6	12.0	10.1	-3.2	-16.7
17	1.5	-7.7	-1.5	3.7	9.7	11.3	13.8	11.7	12.9	4.3	-6.6	-20.1
18	1.6	-7.9	-5.3	0.2	10.9	14.8	16.7	12.9	9.1	2.9	-6.1	-16.5
19	1.9	-6.7	-8.1	-0.5	12.5	16.3	19.3	15.6	9.9	0.2	-6.2	-14.0
20	-8.8	-1.4	-2.1	2.6	13.1	15.6	18.7	17.1	10.6	1.0	-0.7	-16.7
21	-10.3	-0.2	-8.4	3.3	8.1	16.3	18.5	17.6	10.6	1.8	-4.4	-21.8
22	-2.6	-8.8	-6.8	-0.2	11.4	16.7	19.7	17.1	11.3	0.6	-6.1	-23.7
23	0.6	-10.9	-4.1	-2.1	11.9	17.8	19.6	16.8	4.8	3.7	-9.1	-20.7
24	1.2	-13.2	-0.4	-0.2	8.7	18.8	20.2	13.3	1.0	10.1	-6.5	-20.8
25	-0.1	-5.1	0.6	5.2	13.9	17.1	21.3	12.3	2.6	10.3	2.1	-10.8
26	1.3	-0.2	0.1	6.7	15.1	20.2	20.7	12.1	7.9	7.2	0.7	-15.4
27	-1.0	-2.9	4.2	5.6	9.7	20.2	20.6	15.6	1.4	5.5	0.4	-12.2
28	-0.4	-7.0	13.1	5.2	5.7	12.4	15.4	16.2	2.8	4.8	-5.5	-12.6
29	2.9		-0.4	4.9	9.1	10.8	11.9	20.5	8.9	7.5	-6.9	-4.9
30	0.8		1.1	4.4	18.6	8.9	15.9	15.4	8.5	7.8	-2.8	-5.5
31	1.1		-0.7		18.5		15.1	13.6		5.3		-0.9
0 MIN	-12.3	-15.8	-12.7	-7.2	1.0	8.9	11.6	9.1	1.0	-2.4	-9.1	-23.7

MIN of monthly values -2.36900E+01

ESSEX - MIN. DAILY AIR TEMP. (C)

Annual data display: Summary for period ending 1990/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-2.7	-1.4	-6.3	4.2	6.8	10.3	15.6	11.1	18.0	6.3	7.8	2.9
2	-3.8	-4.2	-0.9	0.2	4.0	17.9	14.2	13.5	18.0	6.1	11.9	0.3
3	-1.7	-4.1	-5.1	-1.7	7.1	11.0	16.8	16.3	14.4	11.2	11.3	0.1
4	-0.2	-3.4	-8.9	-0.6	6.0	7.8	23.2	18.2	12.8	11.6	4.2	-5.3
5	-2.7	-3.4	-6.5	-2.0	5.7	8.2	16.2	18.8	17.4	12.1	3.2	-4.2
6	-3.9	0.4	-11.0	-4.2	5.6	14.9	14.0	14.8	17.1	17.1	1.8	-1.1
7	-2.9	0.7	-11.6	-6.8	7.6	14.1	11.2	11.3	14.9	11.8	-0.2	-4.4
8	-2.4	1.4	-7.9	-3.2	13.3	13.9	17.4	11.8	11.6	10.5	-2.3	-1.6
9	1.6	3.3	1.2	5.2	15.8	16.7	21.1	14.1	14.8	8.2	1.7	-1.0
10	-0.6	-2.2	1.8	0.8	3.8	14.2	19.6	14.2	17.3	7.8	1.1	-0.3
11	-1.5	-2.8	3.0	-3.0	3.4	13.4	15.7	16.0	16.2	5.9	-1.8	-0.8
12	-5.1	-5.0	10.9	-5.4	6.7	13.3	17.5	15.4	14.1	6.0	-2.0	2.2
13	-6.8	-1.9	10.8	-0.6	8.3	17.1	16.0	15.1	15.1	5.2	-2.7	-4.0
14	-5.4	-4.9	10.3	3.8	5.8	19.4	16.3	12.4	15.0	5.7	-1.7	-6.8
15	1.0	-4.4	13.1	1.7	12.2	14.5	16.7	15.2	10.9	7.6	7.4	-1.1
16	0.8	-2.7	8.1	-0.4	15.2	13.5	16.8	18.6	9.1	7.2	4.9	-0.9
17	6.4	-8.7	3.3	-2.1	9.9	19.9	19.8	18.9	5.9	13.9	-0.3	-1.3
18	-1.5	-9.6	-0.5	-3.8	9.2	20.5	19.1	20.2	4.7	4.8	-2.7	-0.4
19	-4.9	-6.6	-2.6	1.8	7.0	13.3	19.1	14.9	10.6	2.9	-1.0	-2.0
20	-2.4	-10.0	-5.1	10.1	9.5	14.0	20.5	15.6	8.7	2.5	-0.4	-2.5
21	-1.5	-4.6	-2.4	6.3	7.9	17.9	17.8	16.8	11.8	8.3	4.0	4.4
22	-1.6	0.7	5.2	5.5	7.6	17.4	15.8	17.8	9.4	5.4	4.3	-1.1
23	-2.9	-2.2	-3.6	7.6	6.7	14.3	14.3	18.6	6.4	3.3	1.6	-8.9
24	0.9	-13.0	-5.8	9.1	11.2	12.6	14.9	16.6	4.1	5.9	-0.2	-15.4
25	-0.4	-15.0	-5.6	15.4	9.3	9.1	15.9	16.0	10.9	2.0	2.0	-15.2
26	-3.1	-14.5	-4.7	16.5	12.4	15.3	16.0	19.8	10.6	-0.1	0.6	-15.9
27	-1.2	-3.1	-6.2	15.1	11.2	16.8	16.4	21.8	9.7	3.2	12.8	-15.2
28	-3.4	-7.5	-2.9	14.2	11.4	16.3	17.1	20.1	13.6	3.2	1.5	-3.0
29	-6.2		1.4	11.6	9.1	17.2	19.8	16.6	12.9	0.1	-1.7	1.2
30	-10.7		2.5	10.3	7.7	17.7	17.6	15.3	10.0	5.4	-2.4	-8.1
31	-4.1		2.2		9.0		13.1	15.1		7.4		-11.3
0 MIN	-10.7	-15.0	-11.6	-6.8	3.4	7.8	11.2	11.1	4.1	-0.1	-2.7	-15.9

MIN of monthly values -1.58500E+01

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                 ESSEX -  MIN. DAILY AIR TEMP. (C)

           Annual data display: Summary for period ending 1991/12

Day       JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

   1     -9.1    -12.2     -0.2     -0.8      9.3     18.1     17.5     18.9     11.1     14.2      6.0      1.3
   2     -6.3     -1.4     -2.4     -4.6      7.0     16.4     19.0     17.7     10.9     16.4     -2.5     -1.0
   3    -11.1      0.2     -5.5     -2.0      3.3     13.2     19.9     15.8     13.2     14.2     -6.1     -2.3
   4    -11.5      0.9     -5.2      0.1      5.1     12.5     20.5     13.9     15.4     14.2     -6.9    -12.2
   5     -8.4     -1.1     -8.2      0.1      5.6     10.8     19.4     11.3     14.3      8.4     -7.4    -13.6

   6     -5.4     -1.0      0.0      0.2      7.0     12.9     19.8      8.5     14.0      3.8     -2.8     -7.0
   7    -10.9      0.1     -3.8      0.6      6.7     12.0     19.7     11.3     16.4      3.3     -6.9      1.6
   8    -12.1     -0.9     -7.2      1.2      3.5     13.0     17.6     13.5     19.8      5.5     -9.4      5.3
   9     -2.8     -1.3     -1.0      0.7      9.0     14.9     14.0     16.5     20.4     13.9     -6.0     -0.3
  10     -5.8     -4.6     -7.7      1.3      9.1     18.2     15.8     14.7     17.2      9.9     -3.2     -1.2

  11     -4.6     -7.8    -11.0      1.3     10.2     19.1     18.1     14.1     12.8      5.3      0.6     -2.0
  12     -6.2    -10.3    -13.8      1.5     16.8     14.1     15.6     14.0     12.9      5.2     -1.0     -2.1
  13     -8.6     -3.3    -10.7      1.8     16.3     11.9     17.6     15.9     18.4      4.1      1.6      3.8
  14     -1.5     -5.7     -2.5      1.8     17.6     13.0     15.4     17.6     17.1      5.4      3.1     -3.3
  15     -0.7    -14.4     -2.6      0.6     16.3     21.3     13.6     16.8     22.7      3.8      7.9    -10.5

  16     -0.6    -15.8     -4.1      5.5     17.8     19.5     17.1     19.6     21.2      0.0      0.7    -13.0
  17     -2.9     -4.7     -3.5      2.7      8.4     15.8     19.5     19.0     14.8      5.8     -1.1     -3.9
  18     -4.2     -5.8      2.8      0.2      8.7     17.0     21.0     16.0     12.0      7.7      4.2     -9.4
  19     -1.6      0.7      1.2      5.2      8.6     17.5     23.5     17.2      6.0      1.8     13.1    -10.5
  20     -7.6     -1.7     -0.5      2.1     10.4     19.0     24.1     14.7      4.3      0.2      6.7     -6.8

  21    -13.7      0.6      3.2      2.2     10.3     18.6     23.1     12.7      3.7      5.3      5.7     -2.2
  22    -15.4     -7.1      2.0      3.0     13.4     14.6     21.1     17.8      9.2      8.1      6.1     -3.2
  23     -8.9     -9.2      2.2      4.1     17.0     13.9     20.2     17.0      8.5     13.4     -0.1     -2.0
  24    -12.8     -4.0      2.3      5.7     21.5     14.1     14.7     16.0      5.5     15.2     -3.1     -6.2
  25    -15.9     -4.8      1.1      2.7     20.5     16.3     15.9     14.8      4.2     15.9     -3.2     -3.1

  26    -11.7     -7.0      1.7      8.6     20.4     19.2      9.2     19.9      6.3     14.6     -4.9     -3.6
  27    -10.5     -8.2      9.6     10.4     20.7     21.6      9.5     20.7      2.9      9.3     -0.3     -0.9
  28     -9.1     -6.2      3.0     10.8     20.6     21.5     10.2     19.7      1.4      8.4      1.8     -3.7
  29     -7.9              -2.8     12.9     20.5     23.0     15.8     20.5      5.9      9.6      1.7     -1.2
  30     -8.9              -5.7     15.2     20.6     17.4     13.5     21.4      5.6     10.1      3.7     -3.3
  31    -10.8              -2.1              19.9              12.8     15.0               7.1              -3.9
0 MIN   -15.9    -15.8    -13.8     -4.6      3.3     10.8      9.2      8.5      1.4      0.0     -9.4    -13.6

 MIN  of monthly values -1.59200E+01
1

                 ESSEX -  MIN. DAILY AIR TEMP. (C)

           Annual data display: Summary for period ending 1992/ 6

Day       JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

   1     -3.9    -10.6     -1.7     -4.2      3.0     10.3******************************************************
   2     -2.3    -10.6     -0.8     -5.8     10.9     10.4******************************************************
   3      2.0     -8.0     -1.1     -4.6      6.0     12.3******************************************************
   4      0.1     -4.9     -2.1     -1.0      3.7     14.9******************************************************
   5     -0.2     -8.1      0.5     -2.3      2.7     15.6******************************************************

   6     -0.3     -8.0      3.2     -0.1      3.8     14.2******************************************************
   7     -0.6     -5.3      5.4      5.5      4.2     16.9******************************************************
   8     -3.5    -11.0      6.3      0.8      5.9     12.9******************************************************
   9      1.8    -13.9      3.0      3.5      9.3     12.5******************************************************
  10     -1.5    -11.1    -10.0      1.7      9.8      8.8******************************************************

  11     -2.3    -12.4    -11.4      3.6     11.6     12.5******************************************************
  12     -0.5    -15.8    -13.7     -2.7     14.5     13.0******************************************************
  13      0.5    -11.4    -10.6     -4.0      8.4     15.7******************************************************
  14    -12.1     -1.2     -9.2     -0.8      5.4     15.8******************************************************
  15    -12.8      0.0    -10.7     -2.0      5.5     13.9******************************************************

  16    -19.9     -1.2    -10.9      3.0     10.0     11.4******************************************************
  17    -10.6     -0.3     -3.5      3.4     14.9     16.7******************************************************
  18    -17.9     -0.3     -5.5      2.7      8.1     18.1******************************************************
  19    -19.4      0.0     -3.6      4.7      6.5      8.8******************************************************
  20    -10.9     -0.1     -4.8      9.3     10.8      6.8******************************************************

  21     -6.6     -1.7     -6.3     11.8     12.6      6.1******************************************************
  22     -7.6     -1.3     -8.3      6.1     13.1      6.2******************************************************
  23     -2.2     -0.2     -9.4      4.9      8.4     12.9******************************************************
  24    -10.4     -1.3     -6.2      4.8      4.8     12.6******************************************************
  25    -12.2     -0.5      2.4      3.7      4.5     11.5******************************************************

  26    -11.1     -2.3      2.1      5.4      6.0     13.4******************************************************
  27     -6.6     -0.4     -0.7      3.5      5.2     11.6******************************************************
  28     -3.7     -3.6     -3.7      0.4      6.9     12.1******************************************************
  29     -5.6     -9.5     -0.8      5.7      8.7     15.5******************************************************
  30     -2.1              -0.6      4.2     11.6     13.9******************************************************
  31     -3.2              -0.9              11.9              ******************         *********         *********
0 MIN   -19.9    -15.8    -13.7     -5.8      2.7      6.1******************************************************

 MIN  of monthly values -1.99200E+01
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KETTLE CK. - AVG. DAILY AIR TEMP. (C)

Annual data display: Summary for period ending 1989/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-2.8	1.3	-7.8	1.1	7.7	19.9	19.0	19.8	18.9	14.5	4.6	-5.4
2	-2.4	-7.2	-10.0	3.7	7.5	19.1	21.6	22.9	15.7	15.9	3.2	-1.1
3	-7.1	-8.5	-7.7	5.8	7.6	16.9	22.9	23.6	14.9	6.4	-0.9	-10.0
4	-15.5	-10.0	-0.3	7.3	11.8	14.7	20.3	23.2	16.6	7.0	1.2	-9.3
5	-8.9	-9.8	-4.2	4.7	11.1	14.0	22.6	23.9	19.5	9.5	8.9	-4.5
6	-4.5	-9.0	-8.9	2.2	6.0	15.7	22.6	19.3	19.7	11.5	7.8	-1.9
7	1.2	-10.1	-13.7	1.8	2.4	20.1	23.2	12.7	20.3	6.0	3.2	-9.7
8	-1.7	-10.0	-8.0	2.2	6.8	22.1	19.7	12.7	22.8	3.8	4.4	-9.0
9	-9.6	-13.3	-2.9	-2.0	10.6	18.6	21.6	17.5	22.4	4.5	4.5	-8.3
10	-2.2	-8.6	-0.6	-3.6	9.3	12.9	25.5	18.4	18.2	7.2	3.7	-2.3
11	-5.2	-4.2	2.8	-0.8	7.2	15.3	21.6	19.6	17.7	9.4	4.8	-6.8
12	1.6	-4.6	-1.6	2.0	8.6	13.8	18.9	20.0	17.6	13.3	0.8	-10.4
13	-6.2	-1.8	-1.9	1.0	9.5	14.8	19.0	20.2	12.9	13.7	9.3	-11.2
14	-3.1	1.0	6.0	4.9	9.6	13.9	17.2	20.3	11.3	13.7	12.0	-10.5
15	-1.3	-0.2	2.2	6.7	11.5	15.4	16.5	19.8	12.5	13.4	12.6	-13.3
16	-2.3	-7.2	-0.6	6.6	15.2	14.7	18.3	18.1	12.9	15.6	-0.3	-11.8
17	0.0	-9.6	-1.9	7.0	18.1	13.6	19.4	17.1	16.1	3.5	-4.4	-15.9
18	1.3	-9.6	-3.9	1.5	19.4	18.1	21.2	16.0	15.9	2.2	-5.2	-15.1
19	0.5	-5.4	-5.5	3.5	19.7	18.2	21.2	18.2	15.8	2.2	-2.0	-11.0
20	-4.5	-1.0	-1.7	7.1	15.6	17.8	18.2	19.6	16.4	1.9	4.0	-15.2
21	-8.3	-0.4	-4.5	7.8	15.6	17.7	20.7	20.5	18.8	2.4	-5.5	-17.0
22	-0.8	-4.7	-4.5	3.1	16.9	21.2	22.4	18.4	19.7	6.5	-5.3	-17.1
23	2.0	-14.4	0.4	2.9	13.3	22.2	24.1	18.8	5.7	8.5	-6.2	-14.5
24	1.8	-12.8	2.4	5.6	14.9	24.0	24.9	16.6	6.5	12.5	-3.8	-15.1
25	-2.5	-7.8	5.6	11.7	17.8	23.9	22.5	15.2	9.9	13.6	3.5	-9.3
26	1.5	-2.4	5.6	12.0	18.7	23.4	24.2	16.4	8.7	12.7	2.6	-12.5
27	-1.5	-6.0	12.8	9.7	11.2	21.1	22.4	18.7	5.6	11.7	4.2	-11.0
28	1.8	-4.9	15.5	7.5	11.2	18.0	18.9	20.5	10.0	12.6	1.0	-7.6
29	2.1		4.1	6.7	15.1	15.1	17.9	21.5	12.9	12.0	-6.1	-6.0
30	2.2		1.9	9.6	19.8	17.1	18.8	18.6	10.6	12.5	-2.5	-5.8
31	5.3		-0.1		20.5		19.6	19.2		10.4		0.9
0 AVER	-2.2	-6.5	-1.0	4.6	12.6	17.8	20.9	18.9	14.9	9.4	1.8	-9.6

AVER of monthly values 6.79714E+00

KETTLE CK. - AVG. DAILY AIR TEMP. (C)

Annual data display: Summary for period ending 1990/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-3.3	0.9	-4.1	5.7	11.7	15.8	17.1	17.4	20.9	9.6	11.4	3.7
2	-2.5	-3.4	1.1	3.9	7.3	19.9	19.0	19.4	20.3	11.2	13.8	0.9
3	0.2	-6.2	-5.6	2.1	9.1	17.1	21.1	20.5	15.3	15.6	13.5	0.0
4	1.6	-6.0	-7.8	2.6	7.3	7.2	27.4	19.4	17.8	14.4	8.2	-3.2
5	-3.5	-2.3	-7.5	0.5	9.2	11.6	21.2	19.6	20.8	16.2	4.3	-3.3
6	-4.9	1.4	-8.3	-1.9	8.2	17.0	16.7	17.9	18.0	19.3	2.0	0.9
7	-0.7	0.6	-7.1	-1.0	14.7	17.7	17.6	16.0	18.7	16.6	1.2	-0.5
8	-1.3	4.2	-2.1	2.7	16.9	16.8	21.9	16.8	14.0	9.0	0.7	-0.1
9	1.2	5.1	1.8	8.6	17.8	19.8	23.0	19.3	16.1	7.3	2.4	2.3
10	-0.8	-0.7	3.3	5.7	9.3	14.6	21.1	19.9	19.2	8.9	3.1	1.6
11	-0.1	-2.8	3.4	0.5	5.5	17.1	18.4	18.9	17.1	7.1	0.2	-1.3
12	-5.8	-2.6	11.3	-2.1	6.6	15.8	17.9	17.7	17.8	6.8	-0.4	3.9
13	-6.8	3.8	15.1	2.2	8.8	20.4	17.3	17.6	18.9	8.6	-0.5	0.9
14	-4.3	-3.9	13.3	4.4	11.2	21.9	17.9	16.6	18.4	9.9	3.0	-4.0
15	1.0	-4.0	15.9	4.9	15.6	20.4	20.5	19.5	11.5	10.2	10.8	0.0
16	0.9	-1.2	10.4	4.6	15.7	22.3	20.5	21.5	10.0	9.7	9.4	0.5
17	5.9	-8.5	7.1	0.7	13.0	23.7	23.0	21.5	6.9	17.2	1.7	0.4
18	-1.6	-5.2	1.3	2.2	9.2	22.8	21.9	21.7	8.9	9.7	-0.1	3.0
19	-3.6	-3.9	-1.5	8.2	9.2	14.8	22.7	14.9	11.3	2.9	0.7	-0.6
20	-2.4	-6.8	-2.3	10.1	9.2	15.5	20.6	15.6	13.0	5.4	2.1	-0.6
21	-1.5	-2.2	1.7	9.7	8.9	20.8	19.6	16.5	13.1	11.5	4.8	4.8
22	-0.1	2.2	6.9	9.8	10.8	18.5	16.0	18.1	12.3	8.1	8.2	7.6
23	-1.1	-1.1	-1.3	13.2	12.6	14.7	19.3	19.6	7.1	6.5	3.2	-3.1
24	2.9	-6.1	-4.1	16.2	13.2	11.8	19.5	18.9	9.1	7.2	0.5	-11.2
25	1.2	-14.7	-0.7	21.3	14.6	17.0	20.0	20.8	14.3	4.2	3.8	-8.5
26	-2.4	-12.3	-2.9	21.0	16.1	18.9	20.1	22.5	13.8	2.2	2.2	-14.6
27	2.7	-2.0	-3.5	20.5	17.5	18.2	21.5	23.7	14.2	6.4	14.0	-11.4
28	-1.7	-7.7	0.7	21.5	17.6	17.1	22.8	21.1	17.0	3.0	9.3	-1.5
29	-2.2		1.3	16.4	12.2	20.2	22.8	18.5	15.1	1.7	-0.5	6.3
30	-3.4		4.4	15.6	10.3	18.6	20.2	17.5	10.6	8.5	0.9	-0.3
31	-2.5		5.5		13.5		16.1	18.2		8.2		-8.9
0 AVER	-1.3	-3.0	1.5	7.7	11.7	17.6	20.2	18.9	14.7	9.1	4.5	-1.2

AVER of monthly values 8.36358E+00

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                    KETTLE CK. - AVG. DAILY AIR TEMP. (C)

                      Annual data display: Summary for period ending 1991/12

Day        JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

   1      -4.0    -6.8     5.5     1.6    11.2    20.1    19.0    23.5    13.4    14.9     8.5     1.2
   2      -3.4     0.9     8.9    -0.6     7.4    19.4    19.9    21.3    17.0    19.1     1.2    -2.0
   3      -9.7     2.1    -2.6     2.5     5.4    18.9    21.5    18.2    19.8    15.3    -4.1    -2.3
   4      -9.9     4.1    -3.4     8.4     8.7    14.7    20.8    17.2    17.0    12.7    -5.6    -6.8
   5      -6.0     2.3    -1.0    10.7    10.0    16.4    22.2    16.4    16.2    14.6    -2.8    -7.5

   6      -3.5     1.4     4.0    12.9     9.7    17.6    23.2    17.0    18.5     5.8     1.0    -5.6
   7     -10.0     1.2    -4.5    16.4     8.5    18.2    24.1    19.4    19.2     5.4    -4.2     4.4
   8     -10.3     0.5    -4.3    16.7     8.8    19.8    19.2    17.1    21.8    11.2    -5.7     7.5
   9      -0.8     1.3    -1.7    14.5    11.4    20.7    17.0    19.6    21.2    15.4    -3.4     2.8
  10      -6.0    -2.3    -1.5     3.3    14.1    22.2    18.9    18.7    21.1    10.0    -0.6     1.3

  11      -6.5    -8.0    -6.0     1.8    17.4    19.4    20.0    20.7    15.3     7.5     2.4     2.1
  12      -4.1    -6.6    -5.0     2.9    22.3    17.1    19.7    19.7    15.3     6.0     1.7     3.9
  13      -5.4    -2.9    -1.7     4.4    22.6    14.1    18.2    21.7    17.1     4.7     2.6     6.1
  14       0.2    -3.0     0.4     5.2    22.2    18.4    18.5    19.1    19.2     7.9     5.0    -0.3
  15       1.0   -11.5     1.3     8.3    20.9    23.4    18.4    18.9    25.3     6.0     8.7    -6.5

  16       0.9   -10.4     1.4     9.3    22.8    20.4    20.7    22.3    24.9     4.1     3.5   -10.2
  17      -1.3    -2.8     3.6     4.7    16.4    20.4    23.3    21.1    16.4     9.8     0.1    -3.4
  18      -2.5    -1.0     3.3     5.3     9.7    20.6    24.1    19.9    15.8     9.7     6.4    -9.6
  19       0.8     3.7     3.4     6.4    13.3    22.1    25.5    19.1    10.1     3.5    12.3   -11.2
  20      -1.7    -0.5     3.4     4.6    14.8    23.2    24.8    15.9     7.2     3.3     9.6    -2.5

  21     -13.9     2.4     5.8     3.7    18.3    22.6    24.3    18.3     9.4     8.4     5.3    -0.9
  22     -11.4    -0.8     1.4     5.3    21.1    15.2    24.0    20.1    13.3    11.5     3.4    -1.9
  23      -5.5    -7.7     8.8     8.5    22.4    17.0    23.0    19.5    12.9    15.8     5.5    -0.2
  24     -11.0    -1.6     2.9     8.1    21.0    18.2    20.3    18.0     8.9    15.9    -2.1    -3.7
  25     -13.8    -2.8     1.9    10.2    21.6    20.7    18.8    20.4    10.0    15.7    -2.6    -2.4

  26      -9.6    -7.1     5.3    13.1    20.3    22.3    16.3    22.7     8.4    16.1    -3.3    -2.6
  27      -5.7    -5.7    12.2    16.1    21.5    23.2    16.4    22.8     5.6    11.5     1.3     0.0
  28      -4.5    -3.1     6.0    13.8    22.8    25.1    18.2    23.9     5.8     7.0     1.9    -4.3
  29      -4.1            -2.3    16.2    22.7    25.0    19.4    24.3     8.0     7.6     2.2     0.4
  30      -5.2            -3.3    16.7    23.0    19.9    18.3    24.2    13.3     9.6     9.2    -4.4
  31      -9.1             0.7            22.8            19.6    18.8             8.1            -5.4
0 AVER    -5.7    -2.3     1.4     8.4    16.6    19.9    20.6    20.0    14.9    10.1     1.9    -2.1

AVER of monthly values  8.64162E+00
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                    KETTLE CK. - AVG. DAILY AIR TEMP. (C)

                      Annual data display: Summary for period ending 1992/ 6

Day        JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

   1      -3.5    -9.8     2.7    -1.6    10.5    15.0     0.0     0.0     0.0     0.0     0.0     0.0
   2      -0.4    -6.0    -1.9    -3.8    15.4    15.8     0.0     0.0     0.0     0.0     0.0     0.0
   3       1.9    -1.6    -0.3    -0.8     7.7    18.4     0.0     0.0     0.0     0.0     0.0     0.0
   4       2.3    -2.3     1.8     1.1     6.4    18.2     0.0     0.0     0.0     0.0     0.0     0.0
   5       1.1    -6.8     4.1     0.5     6.3    17.4     0.0     0.0     0.0     0.0     0.0     0.0

   6      -0.5    -4.5     3.1     3.3     7.9    18.6     0.0     0.0     0.0     0.0     0.0     0.0
   7       0.2    -2.1     6.6     8.1    10.4    17.6     0.0     0.0     0.0     0.0     0.0     0.0
   8      -3.1    -9.2     5.3     3.8    12.7    16.2     0.0     0.0     0.0     0.0     0.0     0.0
   9       2.0   -12.3     8.2     5.9    14.2    14.5     0.0     0.0     0.0     0.0     0.0     0.0
  10      -0.9    -7.9     1.7     5.1    16.0    16.1     0.0     0.0     0.0     0.0     0.0     0.0

  11      -1.4    -5.3    -9.8     5.2    17.2    17.7     0.0     0.0     0.0     0.0     0.0     0.0
  12       0.9   -13.3    -9.9     0.1    19.4    19.6     0.0     0.0     0.0     0.0     0.0     0.0
  13       2.1    -5.2    -8.9    -1.1    14.5    21.7     0.0     0.0     0.0     0.0     0.0     0.0
  14      -4.9    -1.1    -8.1     2.2     8.4    20.5     0.0     0.0     0.0     0.0     0.0     0.0
  15     -11.6     0.8    -9.9     3.5    13.3    16.2     0.0     0.0     0.0     0.0     0.0     0.0

  16     -15.5    -1.2    -5.9     4.4    16.9    16.9     0.0     0.0     0.0     0.0     0.0     0.0
  17      -7.7    -0.2    -0.7     4.7    19.0    21.4     0.0     0.0     0.0     0.0     0.0     0.0
  18     -15.6     0.4    -3.6     4.4    12.2    19.4     0.0     0.0     0.0     0.0     0.0     0.0
  19     -15.6     2.3    -1.7    11.0    14.8    12.0     0.0     0.0     0.0     0.0     0.0     0.0
  20      -8.9    -0.1    -2.7    15.8    17.6     6.8     0.0     0.0     0.0     0.0     0.0     0.0

  21      -5.3    -1.3    -3.9    14.8    18.2     6.3     0.0     0.0     0.0     0.0     0.0     0.0
  22      -5.2     0.1    -4.2     9.6    19.6    10.3     0.0     0.0     0.0     0.0     0.0     0.0
  23       1.9     0.1    -5.7     7.4    15.5    12.5     0.0     0.0     0.0     0.0     0.0     0.0
  24      -7.4    -1.8    -1.2     7.1     7.0    12.4     0.0     0.0     0.0     0.0     0.0     0.0
  25     -10.5    -0.1     4.0     4.5     8.1    13.7     0.0     0.0     0.0     0.0     0.0     0.0

  26      -9.6    -1.4     4.9     6.7     9.1    15.7     0.0     0.0     0.0     0.0     0.0     0.0
  27      -3.2    -0.2     1.8     5.3    11.3    13.6     0.0     0.0     0.0     0.0     0.0     0.0
  28      -1.9    -1.3    -1.3     6.3    11.9    15.6     0.0     0.0     0.0     0.0     0.0     0.0
  29      -2.4    -9.6     2.1     8.0    14.9    19.4     0.0     0.0     0.0     0.0     0.0     0.0
  30      -1.2             2.6     8.3    11.5    18.7     0.0     0.0     0.0     0.0     0.0     0.0
  31      -1.8             2.6            12.0             0.0     0.0             0.0             0.0
0 AVER    -4.1    -3.5    -0.9     5.0    12.9    15.9     0.0     0.0     0.0     0.0     0.0     0.0

AVER of monthly values  2.11452E+00
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                         KETTLE CK. - MAX. DAILY AIR TEMP. (C)

                           Annual data display: Summary for period ending 1989/12

     Day       JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

       1       1.1       8.5      -5.3       4.2      10.2      24.2      26.9      26.4      22.1      21.3       7.1      -2.8
       2      -1.0      -6.0      -6.4       6.7      11.0      22.9      28.2      28.2      22.1      21.7       7.1       3.5
       3      -5.7      -6.4      -5.3       8.1      13.1      22.5      28.2      28.2      22.5      10.2       1.8      -8.6
       4     -12.1      -9.0       2.8      10.6      17.3      18.5      23.8      24.6      21.7      12.1       5.7      -6.4
       5      -4.9      -7.9       4.2       6.0      15.0      18.9      28.2      28.2      22.9      15.4      13.1      -0.7

       6      -2.8      -7.1      -6.4       3.9       9.2      20.5      28.2      24.2      23.3      13.9      12.8       1.8
       7       7.4      -7.9     -11.3       4.6       3.9      25.5      27.8      16.9      24.2       8.5       4.2      -7.1
       8       8.5      -6.0      -2.4       6.7      12.1      28.2      25.1      19.3      28.7       7.8       6.4      -3.1
       9      -8.3     -10.9       3.5       1.1      16.1      21.7      28.2      22.5      26.0       9.9       7.4      -3.8
      10       1.8      -5.7       3.9      -0.7      11.3      15.4      30.6      24.6      20.9       9.5       6.0      -1.0

      11      -2.4      -1.7       9.5       2.8      11.7      21.7      26.9      26.0      22.1      13.1       7.4      -2.4
      12       4.6      -2.1       1.1       6.0      11.3      19.3      25.1      27.8      24.2      18.5       3.5      -5.7
      13      -4.2       2.1       3.5       4.9      12.4      17.3      24.2      26.9      14.6      21.7      16.1      -7.1
      14       0.0       2.8      13.5       9.9      13.9      15.8      22.9      26.4      13.5      19.3      13.5      -8.3
      15       0.7       1.1      12.8       9.9      18.1      20.1      24.2      25.1      19.7      20.9      14.6      -9.8

      16       0.0      -2.1       4.2      12.1      21.3      17.3      25.5      22.9      14.6      22.1       7.8      -9.0
      17       1.8      -6.4      -1.0      11.3      26.0      18.5      26.9      23.3      21.7       7.4      -2.4     -12.1
      18       3.5      -5.7      -0.7       4.6      25.5      24.2      27.3      22.9      22.9       3.9      -1.4     -10.5
      19       1.8      -2.1      -3.5       9.9      24.2      22.9      26.4      24.6      22.5       4.9       4.6      -4.6
      20       1.8       0.0       0.4      14.3      17.3      21.7      19.7      22.5      26.0       5.3       8.1     -10.5

      21      -3.5       0.7      -2.4      11.3      22.1      20.9      26.0      26.0      25.5       4.9      -3.1     -14.9
      22       1.8      -1.7       1.4       7.1      22.5      26.6      30.1      23.8      24.6      12.4      -1.7     -12.5
      23       6.0     -12.1       5.3       9.2      15.8      28.5      31.1      21.3       8.8      14.6      -3.8     -10.1
      24       5.3      -7.5       6.4      11.7      18.9      31.0      30.6      22.9      13.5      19.3       2.1     -10.9
      25       0.0      -4.6      13.5      19.7      24.6      29.6      30.1      22.9      15.8      21.3       4.6      -6.0

      26       6.0       1.1      13.5      18.1      24.6      30.5      29.2      25.5      13.1      20.9       4.9      -5.3
      27      -0.7      -3.8      19.3      13.1      13.9      25.5      26.9      27.3      13.9      20.1      12.4      -7.5
      28       6.4      -2.1      18.9      11.7      17.7      22.5      23.3      26.9      17.3      21.3      12.1      -5.7
      29       4.2                12.8       9.5      21.7      21.3      24.6      26.0      19.7      19.7      -3.5      -4.9
      30       4.2                 6.4      15.0      24.2      23.3      25.1      23.3      20.5      20.5      -0.3      -0.7
      31      10.2                 0.4                25.1                25.5      24.6                15.0                 3.9
0 MAX         10.2       8.5      19.3      19.7      26.0      31.0      31.1      28.2      28.7      22.1      16.1       3.9

  MAX  of monthly values  3.11000E+01
1


                         KETTLE CK. - MAX. DAILY AIR TEMP. (C)

                           Annual data display: Summary for period ending 1990/12

     Day       JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

       1      -2.4       3.9       0.4       7.8      16.5      21.7      20.9      24.2      26.0      14.3      20.5       4.9
       2      -0.3      -1.0       5.2       5.7      12.4      24.6      26.0      26.9      25.1      17.3      18.1       3.2
       3       2.8      -4.6      -2.0       3.9      13.9      22.9      28.0      26.4      21.7      20.1      18.9       4.2
       4       4.9      -4.6      -6.1       5.7       9.9      10.2      34.9      24.2      23.8      19.7      13.1       2.1
       5      -0.7       1.1      -4.4       2.8      13.5      16.1      26.1      22.1      25.1      20.9       8.1       1.1

       6      -2.1       6.0      -5.2       1.8      12.4      20.9      20.9      21.3      21.7      23.3       3.9       1.4
       7       3.2       4.6      -2.4       1.1      22.1      22.5      23.3      21.7      23.3      20.1       3.2       1.8
       8       2.5       7.4       3.8       9.5      22.9      22.1      26.9      22.9      20.5      10.6       3.9       2.1
       9       2.1       9.2       4.4      14.3      22.1      25.1      26.7      26.0      23.8       8.5       6.7       7.4
      10       0.7       1.4       4.8       8.1      16.9      16.9      25.7      25.5      25.5      12.4       5.3       4.2

      11       2.5       0.4       4.5       3.2      11.7      23.3      22.6      25.5      22.9       9.2       2.1       0.7
      12      -3.1       1.4      19.4       0.4       9.9      18.9      21.4      25.1      25.1       8.5       1.1       9.5
      13      -6.0       9.5      20.0       6.4      14.3      26.4      21.9      22.5      26.4      14.3       0.7       9.2
      14      -0.3      -2.8      20.4       7.1      16.5      26.9      19.5      22.5      22.5      15.4       7.4      -1.4
      15       4.2      -1.7      23.0       9.9      21.3      25.5      23.6      24.2      13.1      13.5      14.6       1.8

      16       3.2       1.4      12.7       9.9      18.9      28.7      24.7      26.4      14.6      15.0      13.5       1.8
      17       8.5      -2.8       9.8       7.1      15.4      28.2      28.2      26.4      12.1      20.5       4.6       3.5
      18       8.5       1.8       4.1       8.1      11.7      26.9      28.3      26.0      15.4      18.5       5.3       6.4
      19      -1.7       0.0       0.4      13.9      13.1      20.5      28.2      20.9      13.5       5.7       4.6       0.7
      20      -0.7      -4.2       0.1      11.7      13.1      20.5      22.8      17.7      18.5      12.1       7.8       2.8

      21       1.1       2.6       6.0      15.4      11.3      25.5      25.2      19.3      18.5      17.3      10.6       8.1
      22       1.1       4.0      10.5      15.8      16.1      22.5      18.5      21.7      15.8      11.7      12.4      11.0
      23       2.5       1.5       4.2      20.1      17.7      16.9      24.4      23.8       8.5      13.9       8.1      -0.3
      24       5.7      -2.2      -1.9      23.3      18.5      13.9      25.9      23.3      14.6      13.9       4.6      -6.4
      25       6.7     -11.5       3.7      28.2      19.7      22.9      28.4      26.0      17.7       7.4       7.1      -4.9

      26      -1.0      -5.2       0.2      26.9      21.7      24.6      27.6      28.2      19.7       6.0       6.7      -9.4
      27       6.7       0.9       0.4      26.4      23.3      22.1      29.0      28.7      20.5      11.7      16.9      -6.8
      28       2.1      -5.4       7.0      27.3      23.3      21.7      30.9      28.2      24.2       7.1      17.7       1.4
      29      -1.0                 4.9      20.9      15.0      25.1      29.5      22.9      19.3       6.7       1.4      10.2
      30       1.4                 6.4      20.5      15.4      26.9      23.8      23.8      13.9      15.0       4.9       3.9
      31       1.1                 8.1                20.9                20.8      25.5                13.1                -7.1
0 MAX          8.5       9.5      23.0      28.2      23.3      28.7      34.9      28.7      26.4      23.3      20.5      11.0

  MAX  of monthly values  3.49300E+01
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                    KETTLE CK. - MAX. DAILY AIR TEMP. (C)

                      Annual data display: Summary for period ending 1991/12

  Day       JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

    1       0.0      -2.8       9.9       3.2      15.0      24.6      25.1      27.3      19.7      19.3      13.9       2.1
    2      -1.0       4.6      13.1       3.2       9.2      25.1      27.8      26.4      25.1      24.2       6.7       0.0
    3      -6.0       6.0      -1.0       9.2       9.5      26.0      26.9      21.7      27.3      20.1      -2.4       0.0
    4      -5.7       8.8      -2.4      17.3      15.0      19.3      26.4      21.7      21.7      15.4      -2.4      -4.9
    5      -3.8       5.7       3.2      15.4      16.9      22.5      26.9      21.3      22.9      20.5       1.8      -0.7

    6      -1.4       3.2       5.7      18.1      13.1      23.3      28.2      24.2      25.5       8.5       3.2      -0.3
    7      -5.3       2.5      -0.7      24.2      12.4      24.6      31.1      26.0      25.5       9.9      -1.7       5.3
    8      -4.6       2.8      -1.0      21.3      14.6      26.4      22.5      22.9      28.2      15.4      -1.0      11.3
    9       0.0       6.4       0.7      16.9      18.5      28.2      22.9      25.1      26.0      20.1       2.8      11.3
   10      -2.4      -0.3       0.7       8.1      20.9      28.2      25.1      22.9      25.1      13.9       5.3       3.9

   11      -1.4      -6.0      -3.1       5.7      23.8      21.3      25.5      26.0      20.1       9.5       6.4       6.0
   12       0.4      -3.8       1.1       8.1      28.2      20.9      26.4      26.9      23.3       9.9       2.8       9.9
   13      -0.7      -1.4       2.1       9.2      29.2      21.3      22.9      28.2      22.5       8.5       4.6      11.7
   14       1.1      -1.4       4.9       7.1      28.2      25.5      23.3      25.5      25.1      12.1      10.2       3.9
   15       2.8      -5.7       5.7      13.5      29.7      30.1      25.5      24.6      31.6       9.5       9.9      -3.8

   16       1.4      -6.0       8.1      13.5      29.7      22.9      27.8      28.2      29.2       9.5       6.4      -7.9
   17       0.7       1.4       8.8       7.8      22.1      26.4      29.2      26.0      20.5      17.3       4.9       1.4
   18      -0.7       2.1       4.6       9.5      13.1      25.1      28.7      26.0      22.5      14.6      10.6      -5.7
   19       3.5       6.0       8.1      10.2      20.1      28.7      31.1      23.3      14.3       6.4      13.1      -5.7
   20       2.5       0.7       9.9       6.4      21.3      29.2      32.6      18.1      12.1       8.5      14.6       1.4

   21     -11.3       6.7      15.4       4.9      25.1      28.7      28.7      23.3      15.8      12.1       7.1       0.7
   22      -7.5       4.2       3.5       9.5      28.2      16.9      26.4      25.5      18.1      17.7       5.7       1.1
   23      -1.7      -4.9      16.9      13.5      28.7      22.1      25.1      26.0      15.8      21.3       8.1       1.8
   24      -8.3       4.6       5.7      12.8      27.8      26.0      26.4      22.9      14.3      16.9       1.1       0.0
   25     -10.5      -1.7       3.5      16.9      26.4      27.3      23.8      28.2      15.4      16.9      -1.4       0.0

   26      -6.8      -4.9       9.5      20.1      22.5      27.8      22.1      28.7      10.2      18.5      -1.4      -0.7
   27      -1.7      -2.8      15.4      23.3      25.1      26.9      23.3      28.7       9.5      16.9       3.9       4.2
   28      -1.4      -0.3      12.8      18.1      29.2      29.7      24.2      31.6      12.4      10.2       4.6      -0.3
   29      -1.0                 0.7      21.3      28.2      29.2      23.3      31.6      14.6      15.0       5.3       1.1
   30      -3.8                -1.0      19.3      27.3      22.9      21.7      31.6      20.1      16.9      15.4      -0.3
   31      -7.1                 4.2                26.4                24.6      22.9                12.4                -0.3
MAX         3.5       8.8      16.9      24.2      29.7      30.1      32.6      31.6      31.6      24.2      15.4      11.7

MAX  of monthly values  3.26000E+01
1
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                    KETTLE CK. - MAX. DAILY AIR TEMP. (C)

                      Annual data display: Summary for period ending 1992/ 6

  Day       JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

    1       0.0      -6.4       9.5       0.4      16.5      20.5***********************************************************
    2       2.5      -0.7       0.4      -2.1      22.9      22.1***********************************************************
    3       4.2       0.4       4.2       3.2      13.1      24.6***********************************************************
    4       3.5       0.0       8.5       4.6       9.5      23.3***********************************************************
    5       2.5       0.0       9.2       4.2      11.7      20.9***********************************************************

    6       0.0       0.7       7.8       9.5      13.9      23.8***********************************************************
    7       1.1       0.0       7.8      15.8      16.5      20.9***********************************************************
    8      -1.4      -6.4       6.0       9.5      18.9      19.7***********************************************************
    9       4.2      -9.8      12.8      10.6      19.7      20.1***********************************************************
   10       0.7       0.4      12.1      10.6      23.3      22.5***********************************************************

   11       0.0       1.1      -7.9      14.3      23.8      25.1***********************************************************
   12       3.5      -7.1      -7.9       3.2      25.5      26.9***********************************************************
   13       3.5      -0.7      -7.1       3.5      19.3      28.2***********************************************************
   14       2.1       2.1      -5.3       8.1      13.1      25.5***********************************************************
   15      -8.3       2.5      -7.1       9.5      21.7      21.3***********************************************************

   16     -13.3       1.1       0.7       7.8      24.2      24.6***********************************************************
   17      -4.9       1.4       3.9       7.1      26.9      28.7***********************************************************
   18     -12.1       2.1       0.4       7.1      18.9      24.6***********************************************************
   19      -8.6       4.9       3.2      19.3      22.9      16.9***********************************************************
   20      -6.8       0.7       1.1      22.1      24.6       8.8***********************************************************

   21      -2.1       1.8      -1.4      17.3      24.2       8.5***********************************************************
   22      -0.3       3.2      -2.1      12.8      27.8      16.5***********************************************************
   23       3.5       1.1      -1.4      11.3      26.4      17.7***********************************************************
   24      -1.7      -1.4       3.9       9.5      10.2      15.0***********************************************************
   25      -7.5       1.4       8.1       6.4      13.1      20.5***********************************************************

   26      -5.3       0.0       9.9      11.0      11.3      22.9***********************************************************
   27      -0.3       3.2       3.2       9.9      16.1      17.7***********************************************************
   28       1.1       1.8       2.5      12.8      17.7      21.7***********************************************************
   29      -1.0      -4.2       8.1      12.8      20.5      25.1***********************************************************
   30       0.4                 5.7      11.7      14.3      24.5***********************************************************
   31       0.4                 7.8                13.9           *******************          *********          *********
0 MAX       4.2       4.9      12.8      22.1      27.8      28.7***********************************************************

 MAX  of monthly values  2.87000E+01
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1

                        KETTLE CK. - MIN. DAILY AIR TEMP. (C)

                         Annual data display: Summary for period ending 1989/12

  Day      JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

    1     -5.7     -6.4    -11.7     -1.0      4.9     16.5      9.5     12.8     14.6      6.4      1.4     -7.9
    2     -6.0     -8.6    -14.9      0.7      4.9     14.6     11.7     17.3     10.2      8.8     -0.7     -7.5
    3    -11.7    -10.1    -10.9      4.2      3.2     13.1     16.1     16.9      7.4      2.1     -4.2    -11.3
    4    -19.3    -11.3     -5.7      5.3      4.6     11.7     18.1     21.3      8.8      2.5     -4.2    -13.3
    5    -13.7    -12.1     -7.9      3.2      8.1      9.9     18.1     19.7     16.5      2.1      3.2     -7.1

    6     -7.5    -10.5    -12.1      0.0      2.5      8.8     16.5     12.4     16.9      7.8      3.9     -7.5
    7     -2.8    -11.3    -17.0     -1.4      0.7     14.3     17.3      7.4     17.7      3.2      1.4    -14.1
    8     -8.3    -14.1    -14.1     -1.7      3.2     15.0     12.8      7.4     18.1      1.4      1.8    -13.3
    9    -10.9    -16.6     -9.4     -7.1      4.2     14.3     13.1     11.3     18.5      0.7      1.4    -14.9
   10    -10.5    -12.5     -4.9     -7.5      7.4      8.8     19.3     13.5     15.8      0.4      2.1     -4.2

   11    -10.1     -8.3     -1.7     -3.5      3.9      7.8     16.1     13.9     13.1      5.7      1.4    -15.7
   12     -3.5     -7.1     -5.7     -1.4      6.7      9.2     15.4     12.8     10.6      7.1     -1.7    -16.6
   13     -7.9     -6.8     -6.8     -1.0      6.0     12.4     14.3     13.5     11.3      7.4      0.7    -14.9
   14     -6.8     -0.7     -1.4     -1.0      6.7     12.4     11.7     15.0      9.2      8.1      9.5    -13.7
   15     -3.5     -1.4     -3.8      1.8      6.0     12.8      8.8     15.4      6.4      5.7     11.0    -18.8

   16     -5.7    -11.3     -6.0      0.4     10.2     12.4      9.5     13.1     10.2      7.4     -4.6    -14.1
   17     -3.1    -12.1     -2.8      1.1     10.6      9.5      9.9     10.6     11.7      1.4     -5.7    -19.3
   18     -2.8    -14.1     -7.1     -1.4     11.3     11.7     14.3      9.2      9.5      1.1     -7.5    -20.2
   19     -0.3    -10.1     -8.6     -2.4     15.0     13.1     18.1     11.7     10.2     -0.7     -8.3    -15.7
   20    -12.1     -2.4     -4.6     -1.4     13.1     15.4     16.9     15.8     11.7     -0.3     -3.1    -17.9

   21    -12.9     -2.4     -9.8      2.5      8.8     14.6     16.5     13.5     11.0      0.0     -6.8    -19.7
   22     -3.5    -11.3    -11.7     -0.7      8.5     17.7     16.9     11.3     10.2      2.1     -7.9    -20.7
   23     -1.0    -16.6     -4.6     -3.1     12.1     16.5     18.5     13.1      3.2      2.5     -7.9    -18.8
   24     -0.3    -17.9     -0.3     -1.7     10.2     16.8     18.9     11.3      1.1      8.1     -7.5    -20.2
   25     -3.8    -14.5      1.4      4.6     12.1     17.9     19.3      8.5      2.8      8.8      2.1    -11.7

   26     -1.4     -4.6      0.4      7.4     11.3     16.3     19.7      7.8      2.1      4.9      0.4    -17.0
   27     -3.1     -8.6      3.5      4.9      5.7     17.6     19.3     11.0     -1.7      4.6     -0.7    -17.9
   28     -3.5     -8.3     12.8      4.2      3.5     11.0     11.7     12.4      0.4      7.1     -6.8    -10.1
   29      0.4               0.7      4.6      5.7      8.5     11.0     16.5      6.0      7.8     -9.0     -7.5
   30      0.4               0.0      6.0     15.4      8.8     13.9     12.4      2.1      6.7     -4.2     -8.3
   31     -0.3              -0.3              17.3              13.5     12.4               5.7              -2.1
0 MIN    -19.3    -17.9    -17.0     -7.5      0.7      7.8      8.8      7.4     -1.7     -0.7     -9.0    -20.7

  MIN  of monthly values -2.07000E+01
1

                        KETTLE CK. - MIN. DAILY AIR TEMP. (C)

                         Annual data display: Summary for period ending 1990/12

  Day      JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

    1     -4.2     -4.9    -10.7      3.9      4.9      8.1     13.9     10.2     13.9      3.2      6.0      2.1
    2     -4.2     -7.1     -2.6      2.1      1.1     14.6     12.1     11.0     14.6      5.3      9.5     -1.4
    3     -4.6     -7.9     -8.6      0.0      2.8      9.2     12.4     13.1     10.2      8.5      9.2     -3.1
    4     -2.4     -7.5    -10.1      0.0      6.0      3.5     18.5     15.4      9.9      9.9      3.2     -6.4
    5     -5.7     -5.3    -10.6     -3.1      5.3      2.8     17.5     16.9     15.4      9.9      2.1     -6.4

    6     -7.9     -0.7    -11.2     -5.3      3.2     11.3     11.8     14.3     13.1     15.8      0.7     -0.3
    7     -7.1     -2.8    -11.3     -3.1      6.0     12.8      9.3     10.6     10.6     11.3      0.0     -4.2
    8     -7.5     -1.4     -8.2     -3.8      7.4     12.4     13.2      9.5      7.8      8.1     -1.0     -2.8
    9      0.4      0.4     -0.1      2.8     13.1     14.3     18.4     11.7     10.6      6.4     -1.0     -3.1
   10     -1.7     -2.8      1.4      1.1      1.1     13.1     15.8     14.6     14.6      6.0      0.7     -1.7

   11     -2.8     -6.0      2.7     -3.1      0.4     11.3     14.2     14.6     11.7      3.9     -2.1     -2.1
   12     -7.1     -6.8      2.7     -5.3      1.4     10.6     14.7     12.4     10.2      3.9     -3.5     -2.4
   13     -7.9     -2.4      9.4     -2.8      5.3     15.0     11.5     12.4     12.1      3.9     -2.8     -3.8
   14     -9.8     -6.4      7.7      2.1      2.1     18.1     16.6     10.6     13.9      1.4     -4.6     -7.9
   15     -1.0     -6.4     10.9      1.1     10.2     14.6     17.6     13.5      9.5      6.0      6.0     -2.8

   16     -1.4     -3.8      8.2     -2.4     14.3     14.3     16.6     17.7      4.9      2.5      3.9     -1.7
   17      2.1    -13.7      3.8     -1.4      8.1     17.3     18.6     16.5      1.8     11.0     -2.4     -1.4
   18    -12.9    -14.9     -0.5     -4.2      7.4     15.8     17.1     19.3      1.4      2.8     -3.5      0.0
   19     -6.0     -7.5     -3.8      0.7      5.7      9.9     16.7     13.5      9.2     -0.7     -2.4     -2.8
   20     -4.6    -10.1     -4.6      7.8      7.8      7.8     17.1     14.6      7.4     -0.7     -1.7     -4.2

   21     -3.1     -7.4     -3.1      6.4      6.7     16.5     14.1     14.6      7.8      3.5     -0.3      2.5
   22     -3.1     -1.0      2.6      5.3      4.6     16.1     14.1     15.4      8.1      4.2      2.1      0.4
   23     -6.0     -6.6     -4.3      4.9      7.1     11.7     15.1     15.8      6.0      2.1      0.0     -6.0
   24     -1.0    -11.1     -6.2      8.5      8.1     10.2     13.2     15.0      2.8      2.8     -1.0    -15.3
   25     -1.0    -19.9     -5.9     14.3      6.4     10.6     11.3     16.9      9.2      0.0     -0.3    -15.3

   26     -3.5    -21.9     -7.5     15.0     12.1     12.8     11.6     16.9     10.6     -2.8     -2.1    -16.6
   27     -3.8     -6.5     -8.8     14.3     10.2     13.9     13.4     17.3     10.2     -2.4      7.8    -16.6
   28     -4.2    -10.9     -4.8     16.1     10.2     13.1     15.8     17.7     11.3      0.7      1.1     -6.8
   29     -4.2              -1.1     12.1      7.8     14.3     14.9     14.3     12.8     -1.7     -2.1      1.1
   30     -9.0               1.4     11.0      4.9     14.3     17.1     12.1      5.3      0.0     -4.2     -6.4
   31     -5.3               3.9               4.9              11.7     10.2               4.6             -10.9
0 MIN    -12.9    -21.9    -11.3     -5.3      0.4      2.8      9.3      9.5      1.4     -2.8     -4.6    -16.6

  MIN  of monthly values -2.19100E+01
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                       KETTLE CK. - MIN. DAILY AIR TEMP. (C)

                  Annual data display: Summary for period ending 1991/12

  Day        JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

    1       -9.8     -12.5      -0.3       0.0       9.2      15.0      12.4      18.9       8.1      11.3       4.9       0.0
    2       -6.4      -3.5       0.0      -3.8       5.3      13.5      13.1      17.7       8.8      14.6      -2.4      -3.8
    3      -12.9      -2.1      -4.2      -3.8       1.8      12.1      15.0      15.8       9.5      11.3      -6.4      -4.6
    4      -14.1      -0.7      -4.9      -0.7       2.5       9.9      15.4      13.9      10.2       9.9      -9.0      -9.4
    5      -10.9       0.0      -5.3       8.1       3.9       9.2      18.5      11.3       7.8       5.3      -6.0     -12.1

    6       -6.0      -0.3       0.4       7.4       5.3       9.2      16.5       8.5      12.1       3.5      -3.5      -8.3
    7      -15.3       0.0      -7.1       8.1       5.7       9.9      18.1      11.3      12.1       0.7      -7.1       0.4
    8      -15.7      -0.7      -7.5      13.1       0.7      10.6      12.8      13.5      16.1       4.2      -9.4       3.2
    9       -2.1      -1.7      -3.5      10.2       7.8      11.3      10.2      15.0      17.3      11.3      -9.8       0.0
   10      -10.1      -5.7      -4.9       0.4       8.1      15.8       9.5      14.3      15.0       4.6      -5.3      -2.1

   11       -9.4      -9.0      -9.0      -1.4       9.5      16.9      14.6      15.4      11.7       4.2       0.0      -2.4
   12       -8.3      -8.6     -10.1      -1.4      15.4       9.9      12.8      13.5       7.4       2.1       1.1      -2.8
   13       -9.8      -4.9      -4.6       2.1      15.0       6.0      15.4      12.8      11.3      -0.7       0.7       1.1
   14       -1.4      -5.3      -3.5       2.5      15.8       9.2      12.8      15.0      12.1       0.4      -1.7      -5.7
   15        0.4     -14.5      -2.1       6.4      11.7      18.5       8.8      14.3      18.5       1.4       6.7      -9.8

   16        0.4     -15.3      -3.8       5.7      15.0      15.8      12.4      17.3      20.1      -2.1      -1.4     -13.3
   17       -2.8      -5.7      -2.4       1.1       7.8      13.1      16.9      16.5      11.3       3.2      -3.5      -8.6
   18       -4.9      -5.3       1.1      -0.7       6.0      15.8      18.5      16.1      11.0       4.6      -0.7     -14.5
   19       -2.4       0.7      -0.3       3.9       7.1      16.1      20.1      16.1       6.4       0.0       9.9     -18.3
   20      -10.5      -1.7      -1.7       3.2       7.1      15.8      20.5      14.3       2.5      -3.1       4.6      -8.6

   21      -15.3      -1.4      -0.3       2.5      11.0      15.4      20.5      13.9       4.2       3.5       3.9      -4.2
   22      -16.6      -8.3       0.0       1.8      11.3      13.9      19.3      14.6       4.6       4.9       0.4      -6.4
   23      -10.9     -11.3       1.8       1.4      15.0      11.0      16.9      14.6       8.1      11.3       1.8      -4.2
   24      -14.9      -6.8       1.4       4.6      16.1       9.9      12.1      13.9       3.2      14.6      -3.1      -8.3
   25      -17.9      -4.9       0.7       2.1      17.3      11.0      12.8      12.8       3.5      14.6      -3.5      -7.1

   26      -12.9      -9.4      -0.7       6.7      18.9      15.8       9.2      18.1       3.9      14.6      -5.7      -7.1
   27      -10.5      -9.4       8.8       9.5      18.9      18.9       9.5      16.9       1.8       6.7      -4.6      -4.9
   28       -9.8      -7.9       3.2      10.2      17.7      20.1      10.2      18.1      -1.7       4.6       0.0     -10.5
   29       -8.3                -4.2      10.2      17.7      21.3      15.8      17.7       2.1       3.2       0.4      -0.3
   30       -7.5                -4.9      12.4      18.5      14.6      13.5      18.1       1.8       4.6       2.5      -9.4
   31      -10.9                -4.6                19.3                12.8      10.2                 4.6                -9.4
0 MIN      -17.9     -15.3     -10.1      -3.8       0.7       6.0       8.8       8.5      -1.7      -3.1      -9.8     -18.3

  MIN  of monthly values -1.83000E+01
1

                       KETTLE CK. - MIN. DAILY AIR TEMP. (C)

                  Annual data display: Summary for period ending 1992/ 6

  Day        JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

    1       -7.1     -13.7      -3.5      -4.6       3.5       8.5*********************************************
    2       -2.8     -14.1      -3.1      -6.0       6.7       8.1*********************************************
    3        0.4      -3.1      -2.8      -4.6       4.6       8.8*********************************************
    4        1.4      -6.4      -3.1      -1.4       4.6      13.9*********************************************
    5       -0.3      -9.8       0.0      -3.1       3.2      14.6*********************************************

    6       -1.4     -10.9       1.8      -3.5       2.5      15.4*********************************************
    7       -2.4      -6.8       5.7       3.2       0.7      14.6*********************************************
    8       -5.7     -12.1       4.2      -0.7       6.0      11.7*********************************************
    9       -1.7     -16.6       2.1       1.4      10.2       9.2*********************************************
   10       -2.1     -17.4      -9.8       0.7      10.6       7.4*********************************************

   11       -3.1     -13.3     -11.3       1.1      10.2       7.8*********************************************
   12       -1.7     -20.2     -12.1      -3.5      12.4      10.6*********************************************
   13        0.7     -11.3     -10.9      -5.7       7.4      13.9*********************************************
   14       -8.6      -2.8     -11.7      -3.8       3.5      14.3*********************************************
   15      -14.9      -0.7     -13.7      -1.7       3.9      10.6*********************************************

   16      -17.4      -3.8     -13.7       1.1       7.4       8.5*********************************************
   17      -10.9      -2.4      -6.4       3.2      13.9      13.1*********************************************
   18      -18.8      -0.7      -8.6       2.1       7.4      16.5*********************************************
   19      -20.2      -0.3      -4.6       4.9       5.3       7.1*********************************************
   20      -10.9      -1.0      -6.8      11.0      10.2       4.6*********************************************

   21       -8.3      -3.5      -7.5      12.8      11.3       3.7*********************************************
   22      -10.5      -2.8      -7.1       5.7       8.5       1.     .****************************************
   23       -0.3      -1.0     -11.7       3.5       7.4       6..-..******************************************
   24      -10.1      -3.1      -6.0       2.8       4.2      10.6*********************************************
   25      -12.5      -1.7       0.0       1.8       1.8       7.4*********************************************

   26      -14.5      -2.8       2.5       3.5       6.7       8.8*********************************************
   27       -7.5      -3.8      -1.4       1.1       6.0       9.5*********************************************
   28       -4.2      -6.8      -3.1       0.0       3.5       7.4*********************************************
   29       -3.5     -14.1      -4.9       2.1       3.5      11.7*********************************************
   30       -2.8                 0.0       4.2      10.6      14.3*********************************************
   31       -6.0                -1.7                10.6           ***************        ********        ********
0 MIN      -20.2     -20.2     -13.7      -6.0       0.7       1.8*********************************************

  MIN  of monthly values -2.02000E+01
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PITTOCK - AVG. DAILY AIR TEMP. (C)

Annual data display: Summary for period ending 1989/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-4.3	1.1	-8.7	1.2	7.9	19.9	21.0	20.9	19.0	13.7	3.8	-7.1
2	-2.6	-9.0	-11.7	3.9	7.0	19.0	23.4	23.4	15.1	15.5	2.5	-2.7
3	-8.0	-10.2	-9.3	6.3	6.6	17.6	24.3	25.0	15.7	5.2	-1.3	-12.4
4	-17.8	-10.8	-1.3	6.9	11.4	15.1	21.0	23.0	15.9	6.9	-1.0	-11.0
5	-11.1	-10.3	-4.9	4.9	11.7	13.9	22.7	24.6	19.1	9.6	8.2	-5.6
6	-5.5	-9.1	-10.6	2.1	6.0	16.8	23.7	17.2	19.0	11.0	7.6	-2.5
7	-0.2	-10.6	-16.3	1.4	1.5	20.9	21.8	11.0	20.3	4.7	2.3	-10.1
8	-1.4	-11.1	-10.5	1.6	6.3	21.1	19.9	13.6	22.6	3.7	3.4	-9.2
9	-10.3	-13.8	-4.2	-2.0	10.2	18.0	23.2	17.6	22.6	3.5	4.2	-9.3
10	-2.7	-9.6	-1.9	-4.0	9.5	21.1	24.3	19.7	17.8	5.5	3.1	-3.0
11	-6.3	-4.6	1.8	2.7	7.1	17.8	20.5	21.2	17.7	8.8	4.1	-7.5
12	1.1	-5.3	-3.3	1.1	9.1	15.5	18.0	20.8	17.6	13.3	1.0	-11.2
13	-6.7	-2.8	-2.3	0.5	9.5	15.3	18.0	20.3	11.9	13.7	8.9	-12.3
14	-4.0	0.7	4.9	4.9	10.5	13.7	16.3	21.0	10.5	12.0	12.4	-12.1
15	-1.4	-0.7	2.2	5.9	11.3	15.0	17.2	19.2	12.4	11.2	13.1	-12.7
16	-2.7	-9.1	-1.8	6.8	16.2	14.1	19.6	17.9	12.7	15.4	0.4	-11.2
17	-0.5	-10.7	-3.9	7.4	19.6	13.2	20.6	16.6	15.9	2.4	-5.4	-14.3
18	0.9	-10.8	-5.0	1.2	21.1	18.7	22.2	15.5	15.4	1.3	-5.5	-14.6
19	0.5	-5.5	-6.5	3.7	20.5	19.4	20.6	18.2	15.0	1.6	-3.2	-11.5
20	-5.7	-1.3	-2.6	7.6	16.3	17.4	17.6	19.3	16.7	2.3	3.2	-15.0
21	-10.6	-0.6	-5.4	6.9	15.5	17.2	20.1	20.0	18.3	1.8	-6.7	-16.8
22	-1.2	-5.4	-5.4	2.6	17.2	20.4	23.0	18.5	19.4	6.7	-6.4	-17.9
23	2.3	-16.2	-1.3	3.1	13.3	22.6	25.1	18.3	5.6	9.6	-7.8	-14.8
24	2.4	-15.1	0.8	6.7	15.4	23.8	25.9	16.0	6.0	13.9	-4.9	-15.4
25	-4.1	-9.6	4.5	12.5	18.6	23.7	23.7	14.6	9.0	14.1	2.6	-10.6
26	0.8	-4.4	4.4	11.1	18.3	23.5	25.2	16.9	7.9	15.7	2.0	-14.4
27	-1.6	-7.2	12.9	12.5	10.0	22.0	22.2	18.9	5.6	14.5	2.8	-12.3
28	2.0	-6.3	16.1	10.1	11.6	15.8	17.5	20.2	11.0	15.0	0.5	-7.9
29	2.0		3.2	6.3	16.0	14.9	18.6	21.3	13.3	14[illegible]	-7.8	-8.1
30	2.0		1.8	9.0	19.5	18.3	19.5	18.2	11.9	14.3	-3.2	-7.8
31	5.4		0.4		21.0		20.0	19.2		10.4		0.1
0 AVER	-2.9	-7.4	-2.1	4.8	12.8	18.2	21.2	19.0	14.7	9.4	1.1	-10.4

AVER of monthly values 6.53541E+00

PITTOCK - AVG. DAILY AIR TEMP. (C)

Annual data display: Summary for period ending 1990/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-3.8	0.9	-3.9	5.2	11.1	17.0	18.6	20.2	20.3	8.9	11.3	3.2
2	-3.3	-5.0	0.4	3.5	5.4	20.7	16.9	15.8	20.0	11.1	14.4	0.6
3	-0.3	-8.1	-7.7	2.4	8.0	17.0	19.1	17.5	14.2	15.3	14.2	-1.0
4	1.7	-7.7	-8.9	2.7	7.3	7.1	21.4	20.6	17.0	14.1	7.8	-2.9
5	-3.8	-3.2	-9.6	0.1	9.6	7.2	26.7	21.1	20.7	15.5	3.6	-4.2
6	-5.6	1.6	-10.1	-2.5	8.4	11.3	18.8	17.9	19.4	19.3	2.0	0.6
7	-1.8	0.4	-9.0	-1.7	13.6	16.9	15.3	15.4	17.5	16.5	1.0	-1.5
8	-1.7	3.7	-3.8	2.6	15.6	17.6	16.6	16.5	12.2	7.9	-0.3	0.3
9	1.0	4.8	0.3	9.0	18.5	15.5	20.5	16.4	15.5	6.2	0.9	1.8
10	-1.1	-1.7	2.6	5.6	9.7	19.4	21.5	19.4	19.2	7.5	2.7	1.1
11	-0.8	-4.0	2.4	0.0	4.8	14.2	18.8	19.4	16.4	7.0	-0.2	-2.7
12	-7.0	-3.3	10.0	-2.7	7.7	17.3	17.4	16.8	18.6	6.9	-0.6	3.0
13	-8.2	3.6	16.2	1.8	9.4	16.7	17.0	17.1	20.2	9.5	-1.4	0.1
14	-5.3	-5.1	15.5	3.9	12.7	21.1	17.8	16.1	18.2	9.9	1.9	-6.1
15	0.6	-5.9	16.6	4.5	16.0	22.1	18.1	19.0	10.6	9.8	11.1	-1.5
16	0.5	-2.6	10.7	4.5	14.0	20.4	19.2	21.1	9.0	9.3	9.6	0.2
17	5.3	-10.8	6.8	0.6	12.8	23.4	19.9	21.7	5.5	16.2	1.1	-0.3
18	0.5	-7.9	0.1	2.5	8.3	24.7	20.9	21.5	8.8	10.0	-1.3	2.2
19	-4.8	-4.2	-2.7	8.7	8.0	19.9	22.5	13.6	10.0	2.2	0.1	-1.3
20	-3.4	-7.4	-3.7	10.3	7.7	14.2	19.9	14.5	11.7	4.8	2.6	-2.4
21	-3.2	-1.7	1.4	10.1	8.7	17.4	21.8	15.8	12.2	10.6	3.3	3.4
22	-1.3	2.4	5.9	11.8	11.1	20.6	19.8	17.5	13.1	7.4	8.5	7.4
23	-2.6	-2.2	-2.7	15.5	12.4	18.8	18.8	19.1	8.1	5.7	3.3	-3.4
24	2.4	-7.7	-5.2	16.7	13.3	14.6	15.6	18.8	7.4	6.7	-0.5	-11.1
25	0.5	-16.9	-1.2	22.1	14.9	11.4	18.6	20.9	11.2	3.1	3.0	-9.6
26	-3.0	-12.2	-4.0	22.4	16.0	17.3	19.3	22.5	13.9	1.6	0.7	-14.4
27	2.0	-3.7	-3.7	22.2	17.5	19.4	20.7	23.6	14.1	5.8	13.8	-12.5
28	-1.9	-8.4	1.7	22.2	18.0	17.5	21.6	20.7	17.5	1.8	9.9	-2.4
29	-2.7		0.6	18.2	12.5	15.1	21.8	17.4	13.6	2.0	-0.9	5.3
30	-3.0		3.1	16.4	10.8	18.6	22.9	17.4	10.0	7.7	0.4	-1.2
31	-2.6		4.2		14.5		23.5	18.6		7.3		-9.5
0 AVER	-1.8	-4.0	0.7	8.0	11.6	17.2	19.7	18.5	14.2	8.6	4.1	-1.9

AVER of monthly values 7.89711E+00

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                              PITTOCK -  AVG. DAILY AIR TEMP. (C)

                              Annual data display: Summary for period ending 1991/12

   Day       JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

     1      -4.4      -8.1       4.8       0.9      11.1      20.1      18.0      22.9      12.4      14.8       6.8       1.2
     2      -3.4       0.5       8.3      -0.6       6.8      19.6      19.3      20.0      15.2      18.9       2.2      -2.5
     3      -8.7       2.1      -4.0       2.4       5.7      18.3      20.2      17.2      19.2      15.2       5.0      -3.1
     4      -9.3       4.2      -4.0       8.8       8.0      14.0      20.3      16.8      17.1      11.4       5.9      -7.3
     5      -6.3       2.5      -0.9      11.1       9.6      16.2      21.2      15.8      17.4      14.3       4.5      -8.5

     6      -4.8       1.4       3.4      14.4       9.9      17.7      23.3      17.5      19.3       5.1       1.4      -4.9
     7     -11.3       0.8      -5.5      18.6       7.8      19.0      23.2      19.1      19.2       4.8       4.9       3.2
     8     -11.7       0.5      -5.6      17.9       8.0      20.6      19.1      18.0      21.4      10.0       5.2       6.6
     9      -2.3       0.7      -2.4      15.2      11.8      21.3      16.8      18.0      20.6      15.0       3.8       2.6
    10      -7.9      -3.6      -2.8       2.7      15.3      22.6      19.3      18.7      20.3       9.9       3.2       1.3

    11      -7.3      -9.7      -8.2       1.3      18.8      18.9      19.8      18.9      14.3       6.2       1.4       1.7
    12      -5.9      -8.4      -6.2       2.1      23.1      16.0      19.7      19.0      14.6       6.0       0.6       3.0
    13      -7.3      -3.7      -2.7       3.6      22.4      14.0      18.1      20.1      16.5       4.0       1.6       5.6
    14      -0.4      -4.0      -0.1       4.1      22.4      18.6      18.2      22.7      18.9       6.2       4.7      -1.0
    15       0.7     -13.8       1.0       7.6      21.6      22.8      19.4      21.0      24.3       5.6       7.8      -7.1

    16       0.8     -13.1       1.7       8.6      23.6      19.7      21.8      19.7      24.5       4.1       2.6     -10.6
    17      -1.8      -4.4       3.5       4.0      15.4      21.1      23.5      22.5      16.0      10.1       2.9      -4.9
    18      -3.2      -1.9       2.4       4.8       8.6      20.4      24.4      20.7      15.0       9.1       5.1     -10.2
    19       0.2       3.3       2.5       6.7      11.8      22.9      26.0      19.7       9.5       2.9      11.8     -13.5
    20      -2.8      -0.9       3.0       4.1      14.5      23.3      25.8      18.5       6.8       3.5       9.4      -4.3

    21     -16.8       2.5       2.9       3.6      18.8      21.8      24.1      16.0       7.9       7.7       3.1      -0.6
    22     -13.4      -1.7       0.3       5.2      22.6      14.8      23.6      18.0      11.8      11.6       2.3      -2.0
    23      -6.5     -10.4       7.8       8.7      23.7      16.5      22.9      20.1      12.4      16.1       5.0      -0.5
    24     -11.9      -3.5       2.2       9.2      22.0      18.6      20.4      19.1       8.2      16.2      -1.8      -5.6
    25     -14.6      -3.3       1.2      11.3      21.3      21.1      18.9      16.3       9.3      16.1      -2.3      -3.7

    26     -11.4      -8.8       4.1      13.4      20.1      22.7      15.8      19.3       7.1      16.5      -3.6      -3.4
    27      -6.8      -7.3      12.3      15.4      22.2      24.0      15.6      22.9       4.4      11.3      -0.3      -1.6
    28      -4.6      -4.5       5.3      12.3      23.5      25.9      17.1      23.5       5.9       6.0       1.4      -6.3
    29      -5.0                -3.3      14.6      23.6      25.3      18.5      23.7       7.4       5.9       0.5       0.4
    30      -6.6                -4.3      17.0      23.7      19.6      18.1      25.0      11.2       8.1       7.6      -5.7
    31      -9.5                -0.3                22.3                19.6      18.0                 7.9                -7.1
0 AVER      -6.6      -3.3       0.5       8.3      16.8      19.9      20.4      19.6      14.3       9.7       3.4      -2.9

  AVER of monthly values  8.34786E+00
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                              PITTOCK -  AVG. DAILY AIR TEMP. (C)

                              Annual data display: Summary for period ending 1992/ 6

   Day       JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

     1      -6.3     -10.7       0.6      -1.5       9.3      14.9       0.0       0.0       0.0       0.0       0.0       0.0
     2      -5.8      -6.1      -3.4      -3.8      15.2      15.0       0.0       0.0       0.0       0.0       0.0       0.0
     3      -4.9      -2.6      -1.7      -0.9       7.2      18.0       0.0       0.0       0.0       0.0       0.0       0.0
     4      -4.0      -3.2      -0.4       1.2       6.8      17.9       0.0       0.0       0.0       0.0       0.0       0.0
     5      -6.6      -8.4       2.7       0.4       6.4      16.6       0.0       0.0       0.0       0.0       0.0       0.0

     6     -17.2      -6.1       1.7       3.1       7.7      18.7       0.0       0.0       0.0       0.0       0.0       0.0
     7     -16.3      -3.0       4.8       7.3       9.9      17.6       0.0       0.0       0.0       0.0       0.0       0.0
     8     -11.6     -10.7       3.2       3.9      12.6      15.2       0.0       0.0       0.0       0.0       0.0       0.0
     9       1.2     -14.6       7.9       6.4      14.3      14.1       0.0       0.0       0.0       0.0       0.0       0.0
    10      -1.4     -10.2       2.6       4.6      17.2      16.2       0.0       0.0       0.0       0.0       0.0       0.0

    11      -1.6      -6.9     -10.5       2.0      17.5      17.8       0.0       0.0       0.0       0.0       0.0       0.0
    12       0.7     -16.4      -9.0      -0.6      19.3      19.7       0.0       0.0       0.0       0.0       0.0       0.0
    13       1.2      -7.4      -9.6      -1.6      14.7      22.5       0.0       0.0       0.0       0.0       0.0       0.0
    14      -6.6      -1.5      -8.3       1.6       8.9      19.3       0.0       0.0       0.0       0.0       0.0       0.0
    15     -13.5       0.2     -10.6       2.4      12.0      15.7       0.0       0.0       0.0       0.0       0.0       0.0

    16     -15.6      -1.4      -6.5       2.5      15.5      15.5       0.0       0.0       0.0       0.0       0.0       0.0
    17      -8.3      -0.3      -0.8       4.1      19.0      20.6       0.0       0.0       0.0       0.0       0.0       0.0
    18     -15.0       0.2      -3.8       3.9      12.3      19.4       0.0       0.0       0.0       0.0       0.0       0.0
    19     -15.5       1.7      -2.1       9.3      13.2      12.0       0.0       0.0       0.0       0.0       0.0       0.0
    20     -11.6      -0.7      -3.1      14.4      16.7       6.4       0.0       0.0       0.0       0.0       0.0       0.0

    21      -5.7      -3.2      -4.7      14.6      17.5       5.9       0.0       0.0       0.0       0.0       0.0       0.0
    22      -5.3      -0.9      -5.3      10.3      19.3       9.7       0.0       0.0       0.0       0.0       0.0       0.0
    23       1.7      -0.3      -6.1       7.7      15.9      11.6       0.0       0.0       0.0       0.0       0.0       0.0
    24      -7.9      -2.6      -1.5       7.5       6.5      12.2       0.0       0.0       0.0       0.0       0.0       0.0
    25     -12.1      -0.8       4.1       5.0       7.8      14.5       0.0       0.0       0.0       0.0       0.0       0.0

    26      -9.8      -2.0       4.8       7.3       9.1      15.3       0.0       0.0       0.0       0.0       0.0       0.0
    27      -4.6      -1.6       1.8       5.7      11.0      13.3       0.0       0.0       0.0       0.0       0.0       0.0
    28      -2.7      -2.5      -1.6       6.0      11.7      15.5       0.0       0.0       0.0       0.0       0.0       0.0
    29      -2.7     -11.5       2.0       8.0      13.4      19.3       0.0       0.0       0.0       0.0       0.0       0.0
    30      -1.2                 2.9       8.2      11.3      17.0       0.0       0.0       0.0       0.0       0.0       0.0
    31      -2.8                 2.2                11.9                 0.0       0.0                 0.0                 0.0
0 AVER      -6.8      -4.6      -1.5       4.6      12.6      15.6       0.0       0.0       0.0       0.0       0.0       0.0

  AVER of monthly values  1.65583E+00
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                         PITTOCK -  MAX. DAILY AIR TEMP. (C)

                         Annual data display: Summary for period ending 1991/12

Day       JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

  1      -0.9    -5.3     9.3     2.8    14.0    24.5    23.4    25.9    18.8    18.7     8.5     3.0
  2      -1.1     3.4    12.6     1.9     9.0    23.8    25.4    24.7    24.0    24.8     9.3     0.0
  3      -6.7     5.9    -1.8     7.9     9.9    23.9    25.6    19.3    27.6    19.1     6.3    -0.5
  4      -6.6     7.0    -2.9    17.5    14.5    18.0    26.4    20.2    21.2    13.6     9.2    -4.7
  5      -4.8     5.8     2.9    13.9    14.9    21.3    25.9    20.7    22.6    20.1     7.1    -1.9

  6      -1.7     2.8     5.4    18.6    14.2    22.9    28.1    23.9    24.6     8.3     4.2    -1.3
  7      -6.6     1.4    -0.9    24.9    10.1    23.8    28.8    25.9    25.2     8.3     6.0     4.3
  8      -7.4     3.4    -2.8    21.6    12.9    25.5    22.1    22.1    27.3    15.2     7.9    11.5
  9      -0.2     3.7    -1.3    16.5    17.5    27.0    22.3    23.1    25.6    18.6     7.7    11.7
 10      -3.9     0.0    -0.6     9.6    22.0    27.6    24.2    24.8    23.3    12.7     6.3     3.9

 11      -3.5    -7.9    -5.6     4.7    24.6    20.7    24.5    24.0    18.7     8.4     4.5     5.5
 12      -1.8    -5.9    -0.3     6.5    28.7    19.3    25.8    25.4    22.0     9.3     1.4    10.8
 13      -1.7    -2.1     1.4     8.0    28.9    19.9    22.2    26.9    20.8     7.2     3.6    12.3
 14       0.8    -1.7     4.0     6.3    28.2    24.9    22.5    28.1    24.2    10.8     9.4     3.5
 15       1.1    -7.1     4.1    13.1    29.2    30.6    25.3    26.2    31.0     9.4     8.9    -5.5

 16       1.6    -7.2     7.0    11.7    29.9    21.2    27.4    25.1    29.2     8.6     5.3    -8.7
 17       0.3    -1.0     8.5     5.6    21.3    27.5    29.3    27.9    19.0    17.3     5.8    -0.5
 18      -1.2     0.2     4.0     9.8    12.3    24.5    30.2    25.7    21.1    13.6     9.7    -4.8
 19       3.0     6.6     6.7    11.2    17.7    28.9    31.4    24.4    12.5     5.2    13.1    -6.5
 20       2.5     0.8     7.7     6.6    20.8    28.5    32.2    22.7    10.1     7.7    13.9     0.4

 21     -14.0     5.7    10.9     5.5    25.2    28.0    27.4    18.7    13.5    11.1     5.0     0.6
 22      -8.7     4.4     2.1     7.3    27.4    16.8    27.1    22.4    17.1    17.4     5.7     0.4
 23      -2.7    -7.6    16.6    13.5    28.8    21.5    24.9    26.3    15.2    21.6     7.1     1.4
 24      -9.6     2.6     5.4    13.5    28.0    24.5    25.2    24.5    11.6    17.7     3.2    -0.2
 25     -12.6    -1.7     2.8    17.6    27.2    26.5    23.5    21.0    13.9    16.9    -1.5    -0.2

 26      -8.0    -6.3     9.6    18.8    22.8    28.0    20.4    26.7     9.5    18.5    -2.0    -0.3
 27      -2.4    -4.3    16.7    20.8    25.0    28.1    21.5    29.5     6.7    17.4     2.9     1.9
 28      -1.5    -1.7    13.9    15.5    27.6    30.3    23.5    30.4    10.2     8.1     3.2    -1.2
 29      -3.4             0.0    19.3    28.0    28.4    23.1    31.2    11.9    11.0     2.0     1.4
 30      -4.7            -2.1    19.5    26.5    24.9    21.1    30.6    20.0    14.5    15.0    -1.7
 31      -8.1             3.2            25.5            25.0    21.7            11.7            -1.4
MAX       3.0     7.0    16.7    24.9    29.9    30.6    32.2    31.2    31.0    24.8    15.0    12.3

MAX  of monthly values  3.22400E+01
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                         PITTOCK -  MAX. DAILY AIR TEMP. (C)

                         Annual data display: Summary for period ending 1992/ 6

Day       JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

  1      -0.6    -7.6     4.8     0.6    15.7    20.3************************************************
  2       0.1    -1.6    -0.2    -2.4    20.2    21.4************************************************
  3       0.7    -1.5     1.9     2.5    12.4    24.1************************************************
  4       1.2    -0.5     5.4     5.0     9.8    24.4************************************************
  5      10.0    -5.1     7.4     4.2    10.6    19.9************************************************

  6     -10.2    -0.3     3.2     9.8    12.4    23.5************************************************
  7      -7.6    -1.2     6.4    15.9    16.6    21.0************************************************
  8      -2.8    -8.2     4.2     8.7    19.5    18.7************************************************
  9       3.2   -11.6    13.0    11.8    18.7    20.8************************************************
 10       0.2    -0.6    12.8    10.7    24.3    23.0************************************************

 11      -0.6     0.1    -9.2     5.2    24.3    24.8************************************************
 12       3.3   -10.1    -7.6     2.1    26.3    26.9************************************************
 13       2.2    -2.4    -8.1     2.5    19.9    28.5************************************************
 14       1.0    -0.5    -6.3     6.2    14.1    24.0************************************************
 15     -11.5     1.1    -8.6     7.3    19.6    20.7************************************************

 16     -13.3     0.7     0.6     3.6    23.8    22.6************************************************
 17      -5.9     0.7     2.7     6.4    27.7    27.9************************************************
 18     -11.4     1.3     0.5     6.1    17.5    23.5************************************************
 19     -12.6     3.4     2.4    14.9    20.2    17.7************************************************
 20      -8.5     0.7     0.2    21.2    24.1     8.1************************************************

 21      -2.9     1.4    -2.5    17.1    25.0     7.8************************************************
 22      -1.6     2.5    -2.8    13.7    27.4    16.1************************************************
 23       2.9     2.3    -2.4    10.3    24.4    17.4************************************************
 24      -1.3    -1.4     3.0    10.3    10.1    13.3************************************************
 25     -10.2     0.6     9.1     7.3    12.9    18.9************************************************

 26      -6.5    -0.8     8.8    10.7    11.3    20.5************************************************
 27      -2.4     0.8     3.3    10.5    16.0    17.1************************************************
 28      -1.6     1.0     1.8    11.6    16.5    21.3************************************************
 29      -1.6    -5.2     6.9    13.3    20.7    25.2************************************************
 30       0.8             6.1    10.9    12.4    22.1************************************************
 31       0.4             7.1            13.8            ****************        ********        ********
MAX      10.0     3.4    13.0    21.2    27.7    28.5************************************************

MAX  of monthly values  2.85300E+01
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PITTOCK - MAX. DAILY AIR TEMP. (C)

Annual data display: Summary for period ending 1989/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.4	9.1	-7.3	3.8	11.0	23.2	26.3	26.6	21.5	22.7	5.5	-4.0
2	-0.9	-7.8	-8.5	6.9	11.1	21.5	29.2	27.6	20.1	21.0	5.5	1.7
3	-6.6	-8.0	-6.5	8.7	11.1	22.4	29.1	29.1	21.1	7.3	1.2	-10.1
4	-15.1	-9.6	1.7	10.5	17.1	19.6	23.9	24.8	21.4	10.5	3.3	-8.1
5	-8.1	-8.8	3.7	6.7	15.2	17.9	27.7	29.0	22.6	15.9	13.2	-2.2
6	-3.5	-7.8	-7.8	3.5	9.6	21.3	28.8	23.2	22.5	13.0	11.8	0.4
7	6.9	-9.1	-13.6	3.8	3.3	26.5	27.1	15.2	24.9	6.6	3.8	-7.9
8	8.4	-7.4	-4.6	5.5	10.7	28.4	25.7	18.3	27.2	6.8	5.3	-5.7
9	-9.2	-12.2	0.8	0.6	15.8	21.0	28.1	22.1	25.6	8.0	6.7	-5.1
10	0.8	-6.4	1.9	-1.5	12.0	28.4	29.4	25.5	21.2	8.8	5.7	-0.9
11	-4.2	-2.5	8.2	10.8	10.9	21.0	26.4	25.2	21.9	12.6	7.6	-4.1
12	4.7	-3.6	0.6	4.3	11.2	20.0	23.7	26.2	23.0	17.1	2.0	-4.9
13	-4.4	2.1	3.4	2.7	12.5	18.7	23.3	26.4	13.7	19.8	16.3	-8.2
14	-0.2	2.0	13.2	10.0	14.2	15.2	21.4	26.4	12.7	18.0	14.1	-9.6
15	0.7	0.6	13.4	9.2	16.8	17.6	23.0	24.4	19.6	20.6	14.9	-10.3
16	-1.7	-2.9	3.2	13.3	22.7	17.9	24.9	22.1	14.3	23.3	11.5	-8.4
17	0.8	-7.6	-1.9	10.7	26.0	18.0	26.7	21.5	20.4	5.9	-3.5	-11.7
18	3.1	-7.2	-1.2	4.2	26.6	24.7	27.1	21.0	22.5	2.5	-2.7	-11.9
19	2.1	-2.3	-4.7	8.5	25.7	23.5	25.6	24.2	22.0	4.6	3.4	-8.7
20	2.0	0.1	-0.5	13.0	18.2	20.5	18.7	22.0	23.3	5.0	6.8	-10.3
21	-4.5	1.0	-2.5	11.0	21.1	19.4	24.1	24.3	24.9	3.7	-4.2	-15.5
22	1.7	-1.6	0.0	6.2	21.7	24.4	29.9	22.5	24.2	11.7	-4.9	-15.7
23	6.1	-13.1	3.7	9.1	16.2	26.9	30.5	21.0	9.0	15.5	-5.9	-11.1
24	4.4	-10.2	3.4	12.9	20.7	29.8	30.5	22.0	10.8	19.7	-0.3	-12.9
25	-0.9	-5.3	11.9	19.1	24.4	28.9	30.4	21.0	15.9	21.1	4.1	-6.9
26	5.2	-1.9	12.1	18.5	24.1	28.5	30.2	25.0	11.5	21.3	3.7	-6.0
27	-0.8	-4.9	20.8	19.1	12.2	25.8	26.5	25.5	12.7	20.2	11.7	-8.4
28	6.8	-3.2	19.2	18.5	18.0	21.9	23.0	25.0	18.5	21.1	11.7	-7.2
29	3.8		14.0	9.5	21.9	20.5	23.5	25.0	18.6	20.5	-4.3	-6.7
30	4.2		5.3	14.4	23.2	24.1	24.9	20.9	19.4	20.6	-0.6	-1.8
31	10.1		2.2		25.0		25.4	24.5		15.9		4.2
0 MAX	10.1	9.1	20.8	19.1	26.6	29.8	30.5	29.1	27.2	23.3	16.3	4.2

MAX of monthly values 3.05200E+01

PITTOCK - MAX. DAILY AIR TEMP. (C)

Annual data display: Summary for period ending 1990/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-3.0	3.6	1.1	7.9	15.5	21.5	24.2	23.2	26.6	13.4	19.4	4.5
2	-1.3	-1.7	4.2	5.1	11.6	24.6	21.3	20.3	24.2	15.8	18.2	3.1
3	2.8	-6.1	-3.1	4.1	14.0	22.5	24.9	23.6	20.2	20.1	19.9	1.8
4	4.6	-5.7	-6.8	6.5	10.7	10.2	27.1	26.7	23.0	19.8	12.7	3.2
5	-2.0	0.8	-5.7	1.6	14.6	13.4	34.0	25.7	24.1	20.8	7.1	-0.6
6	-2.7	6.8	-6.3	0.4	13.1	16.2	24.5	21.6	20.3	23.6	4.3	1.5
7	1.7	2.4	-4.1	0.1	22.2	22.0	19.3	20.0	21.2	20.6	2.8	1.3
8	1.8	7.3	2.7	8.0	23.8	22.1	21.7	23.2	17.9	9.3	2.1	2.4
9	1.9	7.9	1.9	14.7	22.4	19.0	25.4	25.0	22.6	7.4	5.7	6.7
10	0.4	0.5	3.8	8.0	16.7	24.5	24.5	25.4	24.1	10.8	5.1	3.2
11	1.8	-2.1	3.5	3.9	10.2	17.4	21.3	24.7	21.8	8.2	0.8	-2.2
12	-4.0	-0.1	19.2	-0.7	11.1	23.1	21.1	23.0	25.7	8.4	0.5	9.6
13	-6.7	8.9	21.0	5.6	14.9	19.4	20.1	20.9	26.0	15.1	0.9	8.6
14	-2.6	-3.2	21.4	7.3	17.8	26.5	19.5	21.1	21.7	15.7	6.6	-2.5
15	2.9	-3.8	22.6	8.3	21.4	25.0	22.3	24.3	12.3	12.9	17.3	0.2
16	1.9	1.1	16.0	9.6	15.8	26.3	23.3	25.9	13.3	14.5	14.0	1.4
17	7.1	-3.0	9.6	6.2	15.9	29.6	22.8	26.0	10.2	20.6	3.9	0.7
18	7.2	0.9	2.4	9.2	10.7	28.5	27.4	25.2	14.8	18.8	3.4	4.6
19	-3.0	-0.4	-0.6	14.4	11.3	25.1	27.6	17.7	13.0	4.2	3.5	0.9
20	-1.2	-5.0	-0.8	12.1	8.4	20.5	26.8	17.1	16.9	11.4	6.7	2.0
21	-1.7	2.6	6.5	15.9	11.9	24.3	26.7	18.4	17.0	16.5	8.7	4.6
22	-0.4	3.7	8.3	18.7	16.8	25.4	21.9	20.1	15.3	10.9	11.5	11.6
23	0.5	0.8	2.6	21.6	17.4	23.1	24.0	23.2	14.2	11.6	7.8	-0.3
24	4.6	-4.3	-3.0	24.8	17.7	16.8	18.2	23.5	13.9	11.7	3.6	-7.0
25	5.5	-13.9	3.1	28.5	20.0	12.6	23.2	25.7	15.9	6.0	6.5	-6.2
26	-1.3	-6.6	0.2	28.3	20.7	22.5	23.9	27.6	19.1	4.7	3.9	-9.5
27	7.0	-0.3	0.5	27.8	22.5	24.8	26.2	27.7	20.6	10.1	16.9	-7.0
28	2.4	-5.7	6.5	27.9	23.2	21.1	27.0	26.9	24.4	7.0	18.4	0.9
29	-1.5		3.7	22.9	15.4	20.0	27.5	22.4	16.1	4.6	0.9	8.9
30	-0.2		5.9	20.7	15.8	23.8	29.0	23.1	11.9	13.6	4.3	3.1
31	-1.5		6.9		20.8		28.2	24.6		12.2		-7.9
0 MAX	7.2	8.9	22.6	28.5	23.8	29.6	34.0	27.7	26.6	23.6	19.9	11.6

MAX of monthly values 3.40500E+01

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                    PITTOCK -  MIN. DAILY AIR TEMP. (C)

                    Annual data display: Summary for period ending 1991/12

Day       JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

  1      -8.9   -10.7    -1.7    -0.7     9.1    16.9    13.0    19.7     7.2    12.2     4.0     0.1
  2      -6.2    -5.7    -1.1    -1.9     4.7    14.4    13.3    15.5     6.0    13.6     0.1    -3.8
  3     -10.9    -1.0    -5.5    -2.7     2.0    11.0    14.8    15.2     7.5    12.6     3.2    -6.3
  4     -11.1     0.9    -5.1    -0.5     2.3     9.3    15.4    14.1    11.8    10.5     3.5    -8.9
  5      -9.2     0.3    -4.5     8.9     4.2     9.4    17.1    11.5    11.1     6.2     0.9   -11.2

  6     -11.7     0.3    -0.2    10.9     6.2    11.3    17.5    10.5    13.6     2.8     0.2    -7.2
  7     -18.2     0.0    -8.2    11.5     5.6    12.1    17.2    13.8    11.9     0.6     3.3    -2.8
  8     -18.2    -1.1    -8.7    15.5     2.8    15.2    12.8    11.8    15.8     3.3     1.9     2.2
  9      -6.9    -0.5    -4.1    10.3     7.3    14.1     9.7    15.8    15.9    12.2     0.3     0.0
 10     -12.3    -7.6    -6.9    -0.3     8.8    17.3    12.8    13.8    14.2     5.9     0.3    -0.6

 11     -11.2   -11.5   -10.6    -1.4    13.3      .2    14.6    16.1    10.3     4.3     0.1    -2.1
 12     -10.1   -11.5   -11.9    -1.9    17.5     9.5    13.7    14.9     6.7     3.7     0.1    -3.2
 13     -11.8    -5.5    -6.3     1.7    17.0     6.8    15.5    13.1    10.6     0.2     0.0    -0.2
 14      -2.0    -6.4    -4.3     1.8    16.8    10.4    13.7    17.2    13.6     0.2     0.4    -7.0
 15       0.3   -17.0    -1.7     6.2    13.1    18.5    11.7    17.8    17.2     1.5     5.6    -9.8

 16       0.3   -20.8    -2.7     5.4    15.5    16.1    15.6    16.0    19.1     0.5     0.2   -12.5
 17      -3.4    -6.8    -1.3     1.4     6.5    13.5    17.1    17.5    12.2     4.0     0.4    -8.9
 18      -5      -5.7     1.0    -0.8     5.1    15.5    19.4    17.3    11.0     3.6     0.2   -14.2
 19      -3.0     0.3     0.2     3.6     5.4    16.8    21.0    16.0     6.8     0.6     9.7   -20.0
 20     -12.9    -2.1    -1.5     2.0     7.1    17.6    20.1    15.3     3.2     0.1     4.0   -16.6

 21     -18.5     0.2    -1.1     1.9    10.1    15.8    20.8    13.4     1.7     3.5     0.9    -3.3
 22     -18.7    -9.2    -0.9     3.7    15.9    12.1    16.9    14.2     3.3     6.8    -0.8    -5.7
 23     -10.6   -14.1     0.4     2.8    17.5    10.1    16.5    15.0     7.9    10.1     2.8    -4.6
 24     -15.3    -7.8     0.5     6.3    18.5    11.7    13.5    14.2     3.9    14.8    -3.1   -11.7
 25     -16.7    -5.8     0.2     3.3    18.2    13.1    12.7    12.7     3.7    15.4    -3.2    -7.1

 26     -15.4   -11.2    -0.8     7.7    17.5    16.2     8.8    12.2     3.9    14.9    -8.6    -8.1
 27     -11.6   -10.5     7.4    10.8    19.6    19.1     7.3    17.8     1.5     6.1    -8.7    -9.0
 28      -8.9    -8.1     1.9    10.4    19.2    21.5     7.8    18.2     1.4     4.5     0.0   -12.1
 29      -7.2            -5.1     9.2    19.5    20.5    15.6    16.9     1.2     3.0    -0.5    -0.9
 30      -8.2            -6.2    13.4    20.9    15.2    13.5    18.5     0.1     3.4     1.8   -10.4
 31     -11.4            -4.7            19.6            13.4    10.2             4.0           -12.2
MIN     -18.7   -20.8   -11.9    -2.7     2.0     6.8     7.3    10.2     0.1     0.1    -8.7   -20.0

MIN  of monthly values -2.07500E+01
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                    PITTOCK -  MIN. DAILY AIR TEMP. (C)

                    Annual data display: Summary for period ending 1992/ 6

Day       JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

  1     -11.1   -14.1    -4.3    -3.9     1.9    10.0************************************************
  2     -10.6   -13.6    -4.4    -5.0     7.7     7.3************************************************
  3     -11.2    -4.2    -3.9    -3.7     4.7    10.6************************************************
  4      -8.9    -8.1    -5.6    -1.9     4.4    11.4************************************************
  5     -12.7   -11.3    -1.5    -2.7     2.8    14.6************************************************

  6     -23.6   -14.4     0.8    -3.7     1.5    15.5************************************************
  7     -22.2    -7.8     3.1     2.0     1.1    14.5************************************************
  8     -19.5   -13.4     2.7    -0.4     5.4    10.0************************************************
  9      -1.9   -18.8     2.8     0.9    11.4     7.2************************************************
 10      -3.1   -21.7   -10.3    -0.2    10.2     8.4************************************************

 11      -2.9   -17.4   -12.2     0.2     9.3     8.1************************************************
 12      -3.1   -23.7   -10.7    -3.9     9.6     9.9************************************************
 13       0.5   -15.7   -14.0    -6.1     5.9    16.3************************************************
 14     -11.9    -2.8   -10.6    -3.4     2.2    13.2************************************************
 15     -16.8    -1.1   -13.3    -2.0     2.0    10.9************************************************

 16     -18.9    -4.0   -14.8     0.5     5.4     7.9************************************************
 17     -12.1    -2.2    -6.1     2.1    11.7    10.9************************************************
 18     -18.1    -0.6    -8.8     2.2     8.4    16.4************************************************
 19     -19.5    -0.8    -5.2     4.3     5.3     7.0************************************************
 20     -17.6    -2.3    -5.8     8.3     8.1     4.4************************************************

 21      -8.1    -6.6    -7.6    12.7     9.6     4.3************************************************
 22      -8.2    -5.4    -7.3     6.5     8.2     2.4************************************************
 23      -0.7    -1.5   -11.1     4.3     7.6     3.3************************************************
 24     -10.8    -4.4    -5.8     4.0     3.5    10.8************************************************
 25     -14.2    -2.4    -0.6     2.7     2.3    10.6************************************************

 26     -16.1    -3.3     3.0     4.9     6.5     8.4************************************************
 27      -8.1    -5.5    -1.3     0.7     5.7     9.6************************************************
 28      -3.4    -8.7    -4.4     0.0     6.0     8.4************************************************
 29      -3.8   -15.8    -3.0     2.2     2.7    13.2************************************************
 30      -3.2             0.2     3.7    10.6    13.0************************************************
 31      -6.9            -1.5            10.3        ****************        ********        ********
MIN     -23.6   -23.7   -14.8    -6.1     1.1     2.4************************************************

MIN  of monthly values -2.36900E+01
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                    PITTOCK -  MIN. DAILY AIR TEMP. (C)

                    Annual data display: Summary for period ending 1989/12

  Day        JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

    1       -8.5    -7.9   -12.2    -0.6     5.4    17.6    13.4    13.7    13.9     4.9     1.0    -8.9
    2       -6.4   -10.6   -15.2    -0.1     4.6    15.9    17.0    18.1    10.8     7.9     0.6    -9.0
    3      -13.4   -12.0   -12.4     4.4     3.7    14.5    18.0    18.4    10.3     3.6    -5.1   -15.6
    4      -21.1   -11.5    -6.3     4.6     3.7    12.0    18.4    20.3     9.7     4.1    -5.8   -15.3
    5      -15.4   -12.1    -9.4     3.0     8.7     9.4    17.6    20.7    16.1     3.8     2.0    -8.7

    6       -8.1   -10.3   -14.1     0.3     1.8    10.6    17.3    10.8    13.9     5.9     4.1    -8.3
    7       -4.2   -12.2   -19.9    -1.0     0.3    15.4    14.5     6.9    17.7     3.1     1.0   -13.2
    8       -9.2   -14.3   -16.6    -1.8     3.2    15.4    12.6     7.1    18.9     1.9     0.7   -12.2
    9      -11.2   -15.2    -9.7    -6.2     3.5    14.6    12.5    13.4    19.5    -0.1     0.6   -14.7
   10       -9.9   -13.6    -6.1    -7.2     6.4    15.4    16.3    14.6    15.9    -0.3     0.7    -6.4

   11       -9.5    -7.5    -2.2    -1.4     3.5    10.9    15.1    13.7    14.2     5.9     1.1   -14.5
   12       -4.7    -8.3    -6.8    -1.0     7.3    12.4    14.5    16.4    12.2     9.7     0.2   -16.3
   13       -8.9    -8.6    -8.1    -1.0     6.6    12.2    12.8    16.3     9.8     8.3     0.5   -15.1
   14       -8.1    -1.2    -0.7    -0.3     7.6    11.9     9.6    15.9     9.3     8.0    10.5   -16.0
   15       -2.6    -1.8    -4.4     1.2     5.4    12.9     9.0    15.7     5.8     5.0    11.4   -16.0

   16       -4.5   -13.1    -6.8    -1.2    10.6    11.2    13.2    13.8     9.7     6.4    -5.1   -15.4
   17       -3.0   -13.4    -5.1     1.2    11.2    10.4    12.8    12.2    12.9     0.4    -6.7   -16.3
   18       -3.5   -14.9    -8.4    -1.3    14.4    11.7    16.3     9.9     7.7     0.2    -7.3   -18.6
   19       -0.6    -9.7    -8.7    -1.5    15.4    15.4    17.2    11.9    10.5    -0.7    -8.8   -14.8
   20      -14.2    -3.0    -6.1     1.3    14.5    13.6    16.2    15.8    10.9     0.0    -3.7   -17.1

   21      -16.1    -3.5    -9.2     2.7     9.6    13.7    16.1    15.2    10.3    -0.1    -7.8   -18.4
   22       -4.4   -13.2   -11.0    -1.3    12.2    17.0    17.3    13.2    11.0     3.4    -7.8   -19.5
   23       -0.6   -19.1    -6.8    -2.8    11.9    18.1    18.3    13.1     3.3     4.3   -10.2   -17.5
   24       -0.4   -20.3    -1.8    -0.8    10.6    18.0    21.0    11.0     0.9     9.4    -6.6   -18.9
   25       -5.4   -18.0     0.4     7.2    13.0    17.9    19.9     8.9     2.2     6.6     1.1   -12.8

   26       -2.9    -6.6     0.3     7.2    10.1    18.8    20.9     9.1     2.1    10.8     0.6   -19.4
   27       -2.8    -9.2     1.8     7.2     6.4    19.2    17.8    12.7     0.3     9.4    -1.9   -16.9
   28       -3.2   -10.8    13.7     4.8     4.3     8.3    11.1    13.8     2.4     9.2    -6.9    -8.6
   29        0.0            -0.2     4.9     8.3     7.7    10.8    17.1     8.0    10.1   -11.2    -9.8
   30        0.6            -0.4     5.2    15.6     9.3    13.9    14.9     5.7    10.2    -4.9   -11.0
   31        0.1            -0.4            18.0            13.3    13.8             5.7            -2.5
0 MIN      -21.1   -20.3   -19.9    -7.2     0.3     7.7     9.0     6.9     0.3    -0.7   -11.2   -19.5

 MIN  of monthly values -2.10900E+01
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                    PITTOCK -  MIN. DAILY AIR TEMP. (C)

                    Annual data display: Summary for period ending 1990/12

  Day        JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

    1       -4.9    -5.3    -9.7     3.6     2.8    11.4    13.5    15.2    13.6     4.1     4.4     1.6
    2       -5.2    -9.2    -2.5     2.0    -1.4    16.5    13.9    12.1    14.5     7.3    10.8    -2.4
    3       -4.3    -9.6   -11.3     0.1     0.0     8.4    11.9    10.9     8.9     9.4    10.6    -3.2
    4       -2.7   -10.1   -11.3     0.1     5.2     4.5    14.8    13.7    10.0     9.7     3.0    -6.2
    5       -5.9    -6.6   -13.2    -3.5     5.7     3.8    19.6    14.8    16.8     9.5     1.2    -6.5

    6       -8.5     0.0   -13.6    -5.7     3.1     4.8    14.1    12.8    15.2    15.6     0.9    -0.3
    7       -9.0    -1.3   -13.5    -3.7     5.2    11.0    10.5    10.3     8.8     9.5    -0.1    -5.3
    8       -7.1    -0.8   -10.1    -2.8     4.1    12.4    10.2     8.4     6.5     7.2    -2.5    -2.0
    9        0.1     0.0    -1.4     3.3    14.3    12.8    14.2    10.3     9.6     4.9    -3.0    -3.4
   10       -2.6    -4.0     1.5     0.6     1.2    14.3    17.7    13.4    15.0     4.6     0.1    -2.4

   11       -3.7    -6.2     1.2    -3.6     0.0    12.6    15.9    14.3    11.4     5.0    -1.9    -3.2
   12       -9.4    -7.0     1.1    -5.1     5.6    11.4    13.8    11.8    11.7     4.4    -1.8    -3.2
   13      -10.2    -2.8    12.0    -2.7     6.5    13.0    14.8    12.6    14.2     6.2    -4.4    -5.7
   14       -8.6    -8.1     9.0     1.4     6.3    15.5    15.9    10.8    13.4     3.1    -4.9   -10.1
   15       -3.1    -8.0    11.0     0.6    11.0    19.4    14.7    13.0     8.4     6.6     6.5    -5.2

   16       -1.1    -5.3     8.4    -1.9    12.1    13.7    14.7    17.4     4.6     4.1     3.8    -1.5
   17        0.7   -17.5     2.7    -1.6     7.6    15.7    16.8    17.7     1.8     9.2    -2.8    -1.6
   18       -2.5   -18.9    -1.3    -3.8     6.0    19.2    16.8    18.6     2.1     2.5    -5.6     0.2
   19       -6.8    -7.4    -6.6     1.6     4.6    12.0    18.0    12.1     7.7     0.2    -4.1    -4.8
   20       -5.7    -9.4    -7.3     8.3     6.8     6.0    17.5    12.3     8.4     0.3    -0.3    -5.7

   21       -4.8    -8.9    -3.6     6.8     6.7    10.2    16.5    13.4     7.1     1.9    -0.6     1.3
   22       -2.8     0.7     2.7     5.3     4.5    16.5    17.2    15.3    10.9     2.9     3.2     0.3
   23       -6.0    -6.6    -5.7    10.1     7.3    16.5    13.4    15.8     5.6     1.2    -0.5    -6.5
   24       -1.1   -13.2    -7.8     8.2     8.6    10.7    13.9    13.9     4.4     3.0    -1.4   -14.7
   25       -1.6   -19.1    -5.5    16.8     7.4    10.0    14.2    15.9     5.4     0.4     0.2   -15.4

   26       -3.8   -18.2    -7.4    17.1    12.1    11.0    14.0    17.6    11.0     0.1    -2.2   -15.9
   27       -4.3    -7.8    -7.6    16.9    12.0    14.2    14.0    18.9     9.9     0.3     4.9   -17.3
   28       -4.3   -10.9    -3.2    16.4    11.8    13.9    14.9    17.3    13.2     0.1     1.0    -6.9
   29       -4.5            -2.1    13.9     7.9    11.2    15.4    13.6    11.9     0.2    -2.4     1.0
   30       -6.0             0.0    11.6     5.3    12.0    16.9    11.9     5.3     1.0    -4.5    -8.5
   31       -5.2             2.5             7.6            17.5    11.8             3.2           -11.2
0 MIN      -10.2   -19.1   -13.6    -5.7    -1.4     3.8    10.2     8.4     1.8     0.1    -5.6   -17.3

 MIN  of monthly values -1.91400E+01
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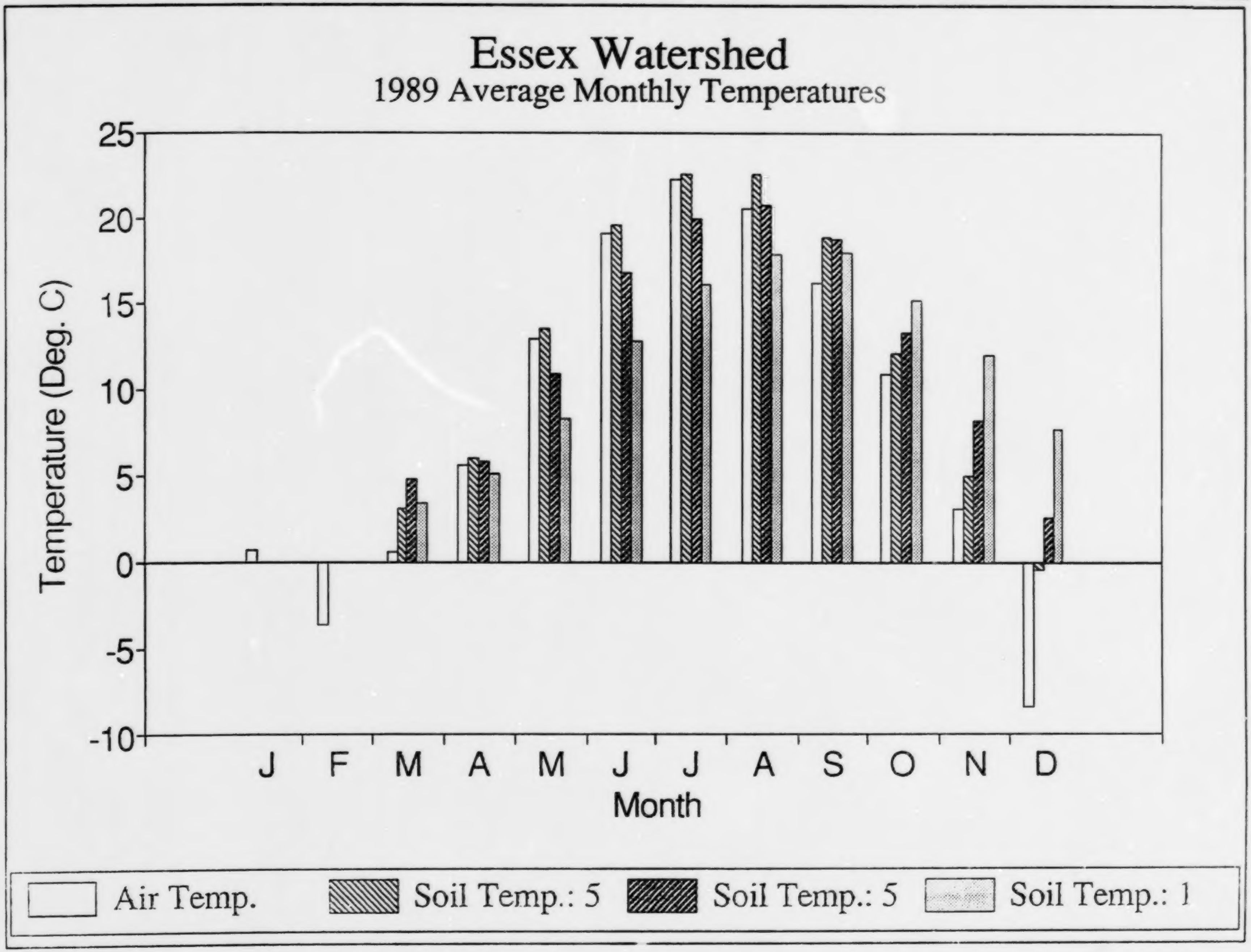
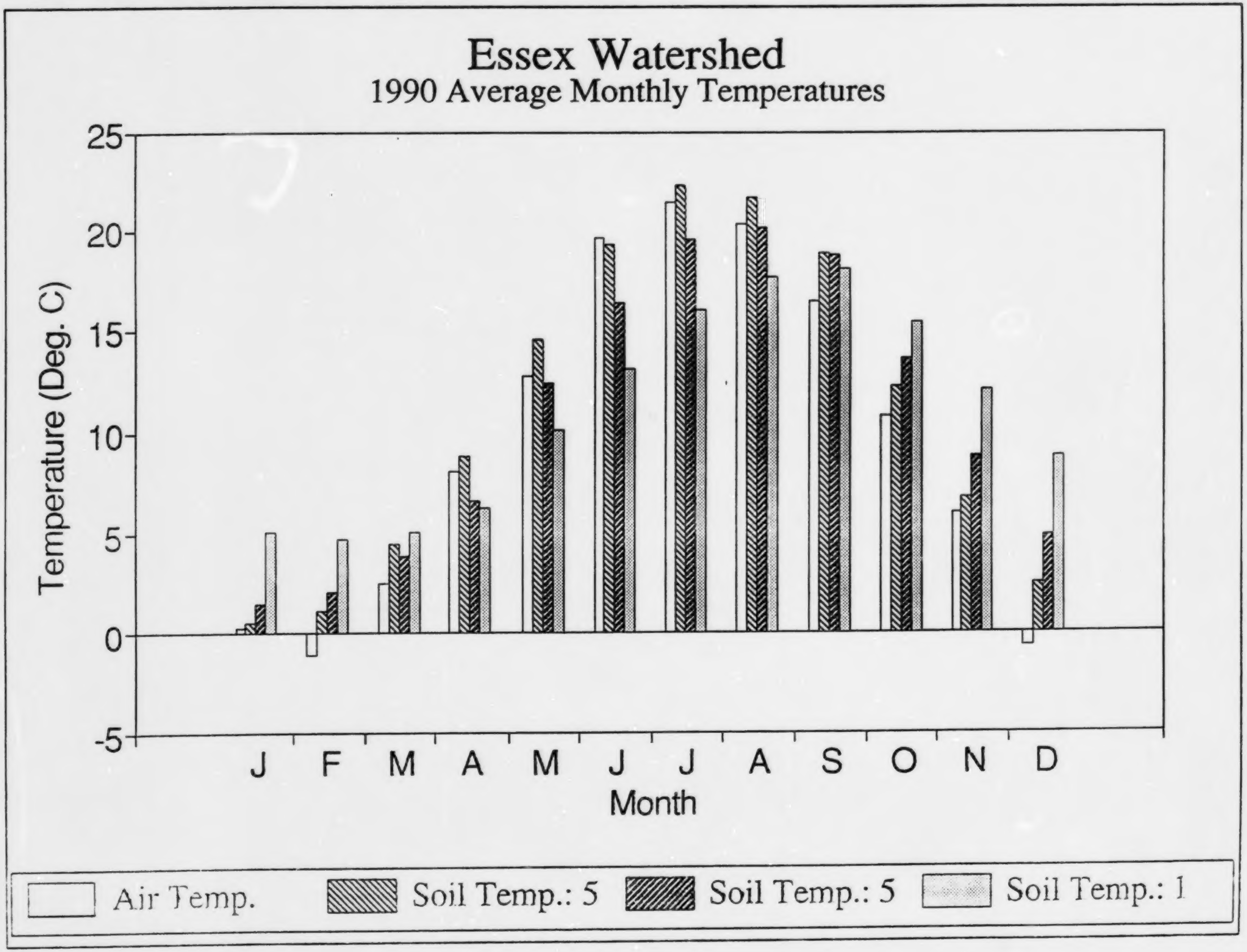
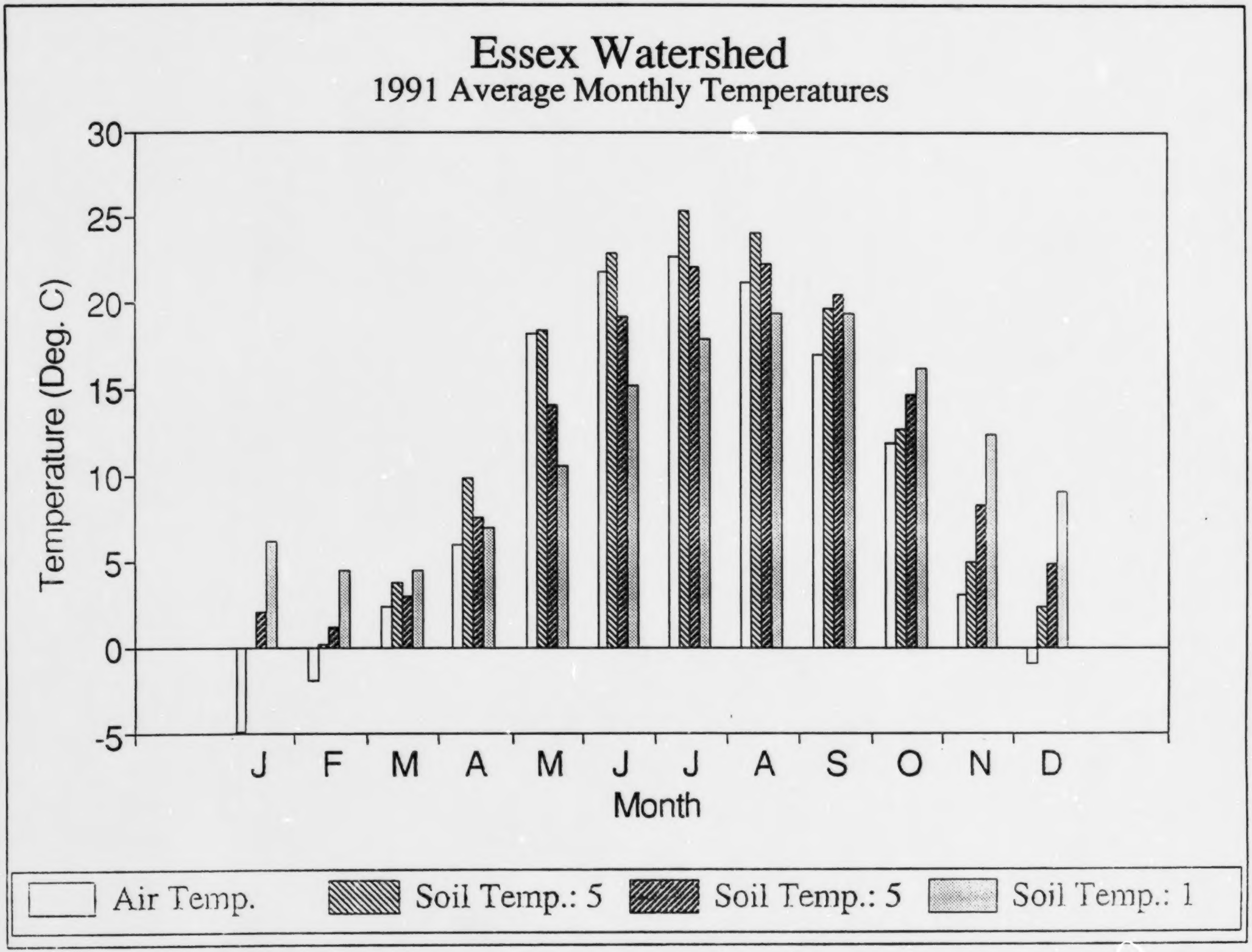
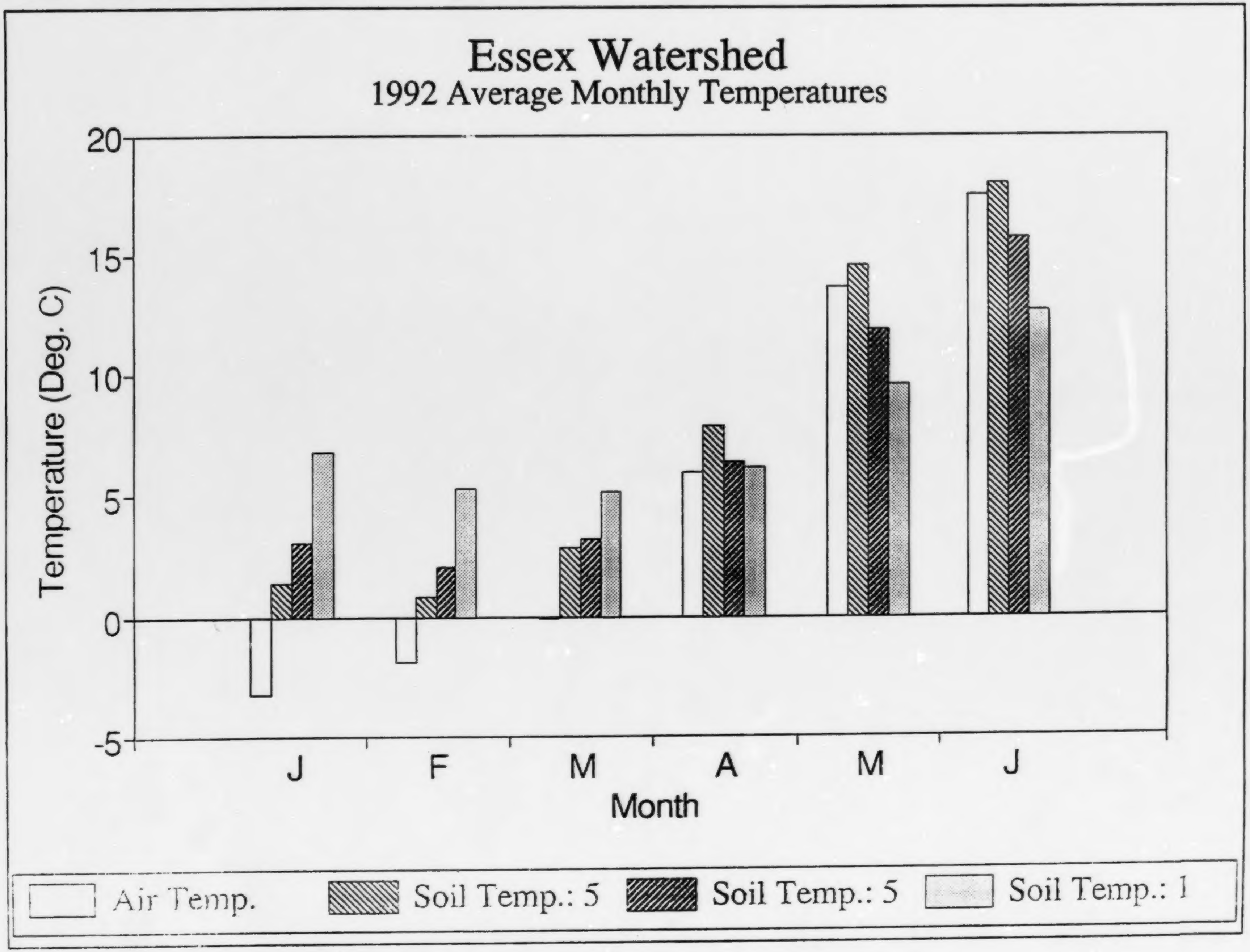


Essex Watershed

1989 Average Monthly Temperatures


Essex Watershed
1990 Average Monthly Temperatures
Temperature (Deg. C)
25
20
15
10
5
0
-5
J
F
M
A
M
J
J
A
S
O
N
D
Month
Air Temp.
Soil Temp.: 5
Soil Temp.: 5
Soil Temp.: 1

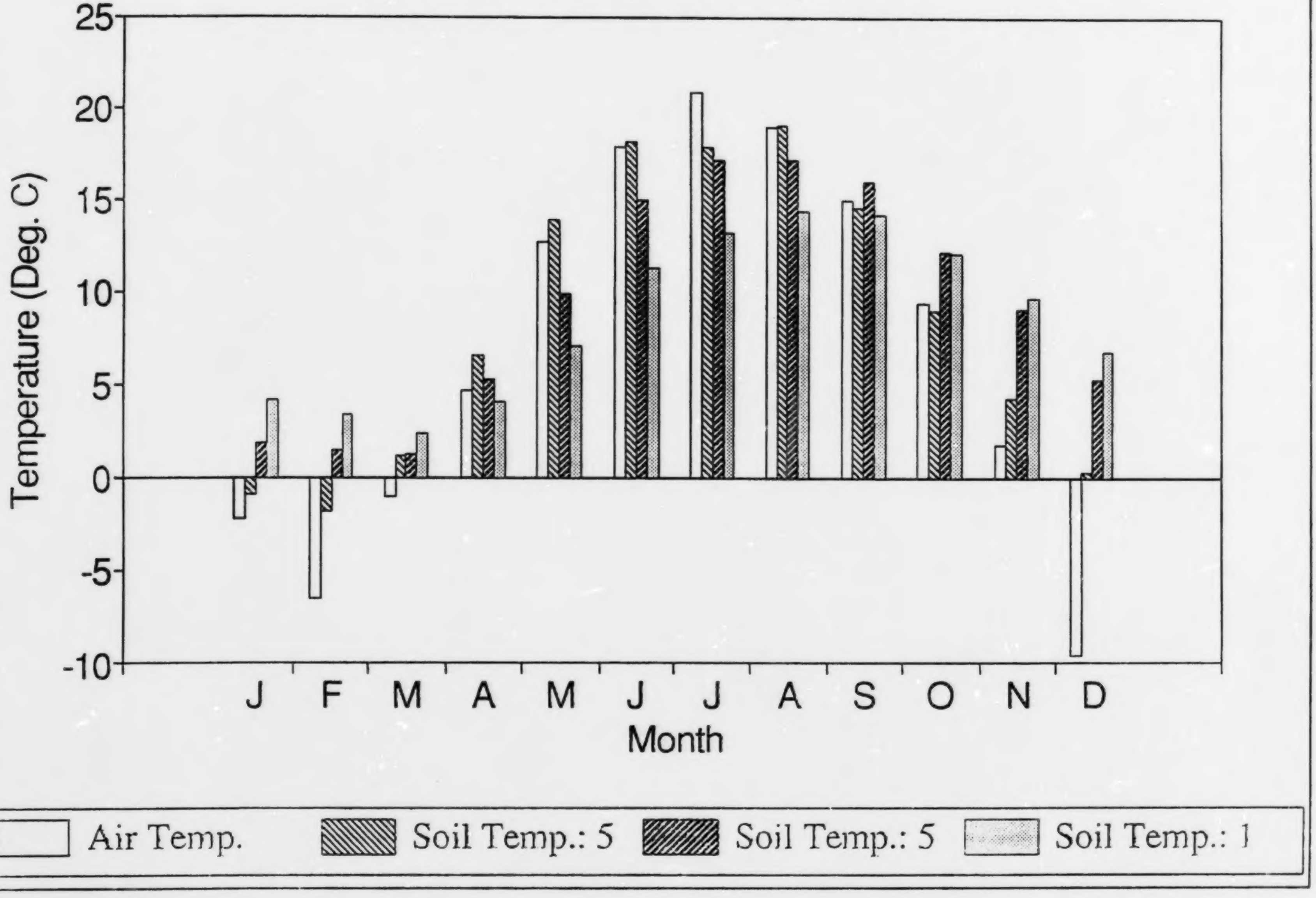

Essex Watershed
1991 Average Monthly Temperatures
Temperature (Deg. C)
30
25
20
15
10
5
0
-5
J
F
M
A
M
J
J
A
S
O
N
D
Month
Air Temp.
Soil Temp.: 5
Soil Temp.: 5
Soil Temp.: 1

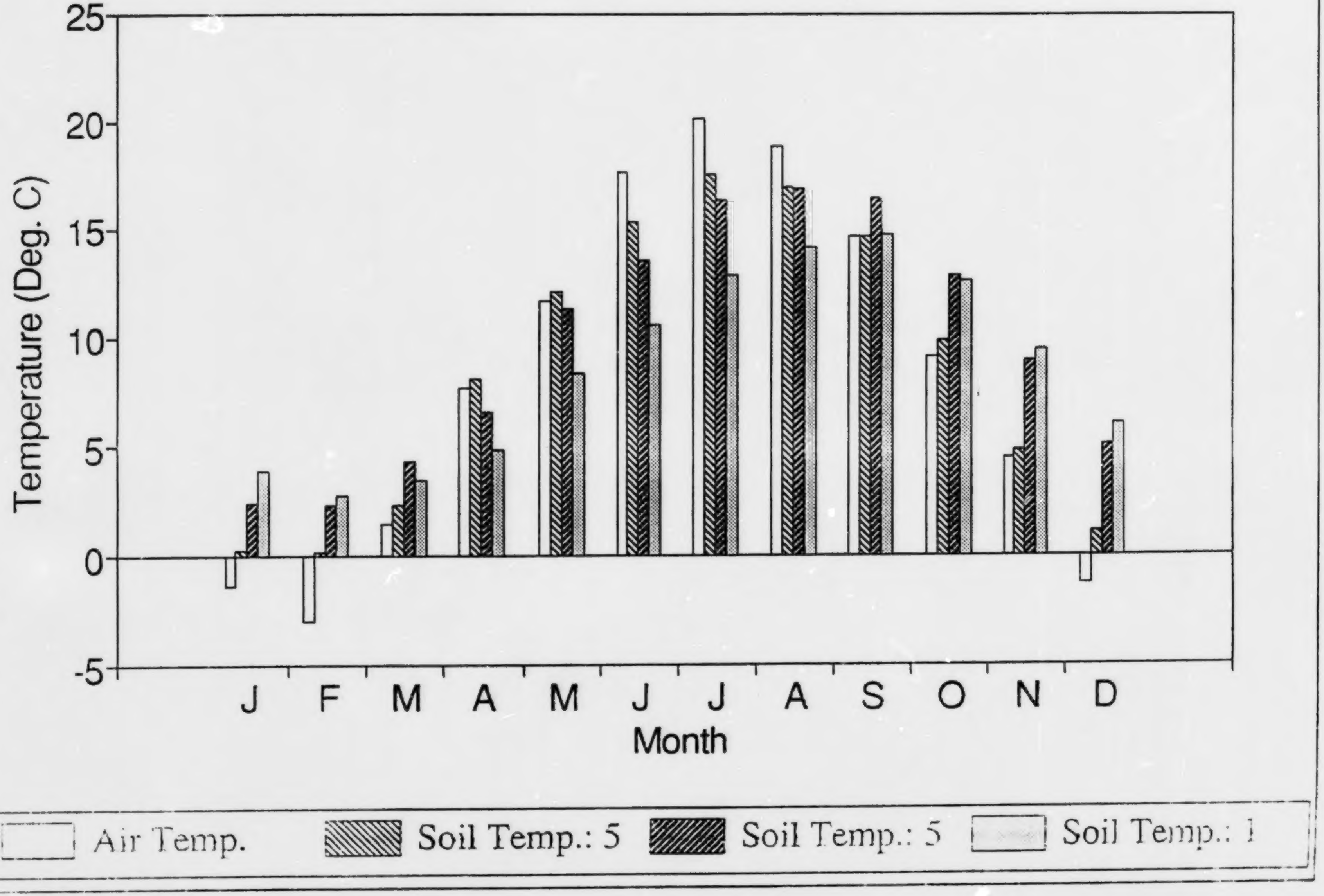


Essex Watershed
1992 Average Monthly Temperatures

Kettle Creek Watershed

1989 Average Monthly Temperatures



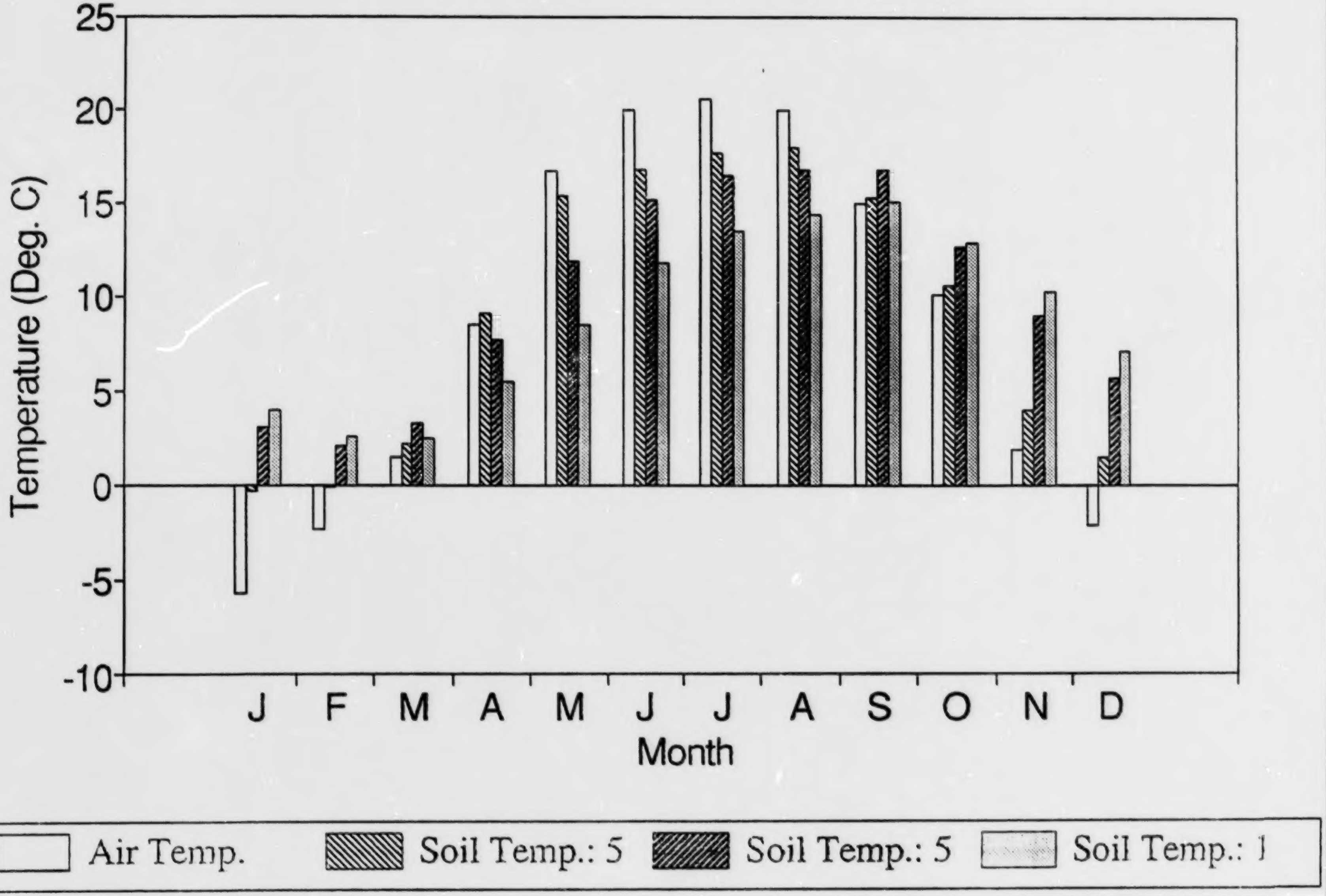


Kettle Creek Watershed

1990 Average Monthly Temperatures

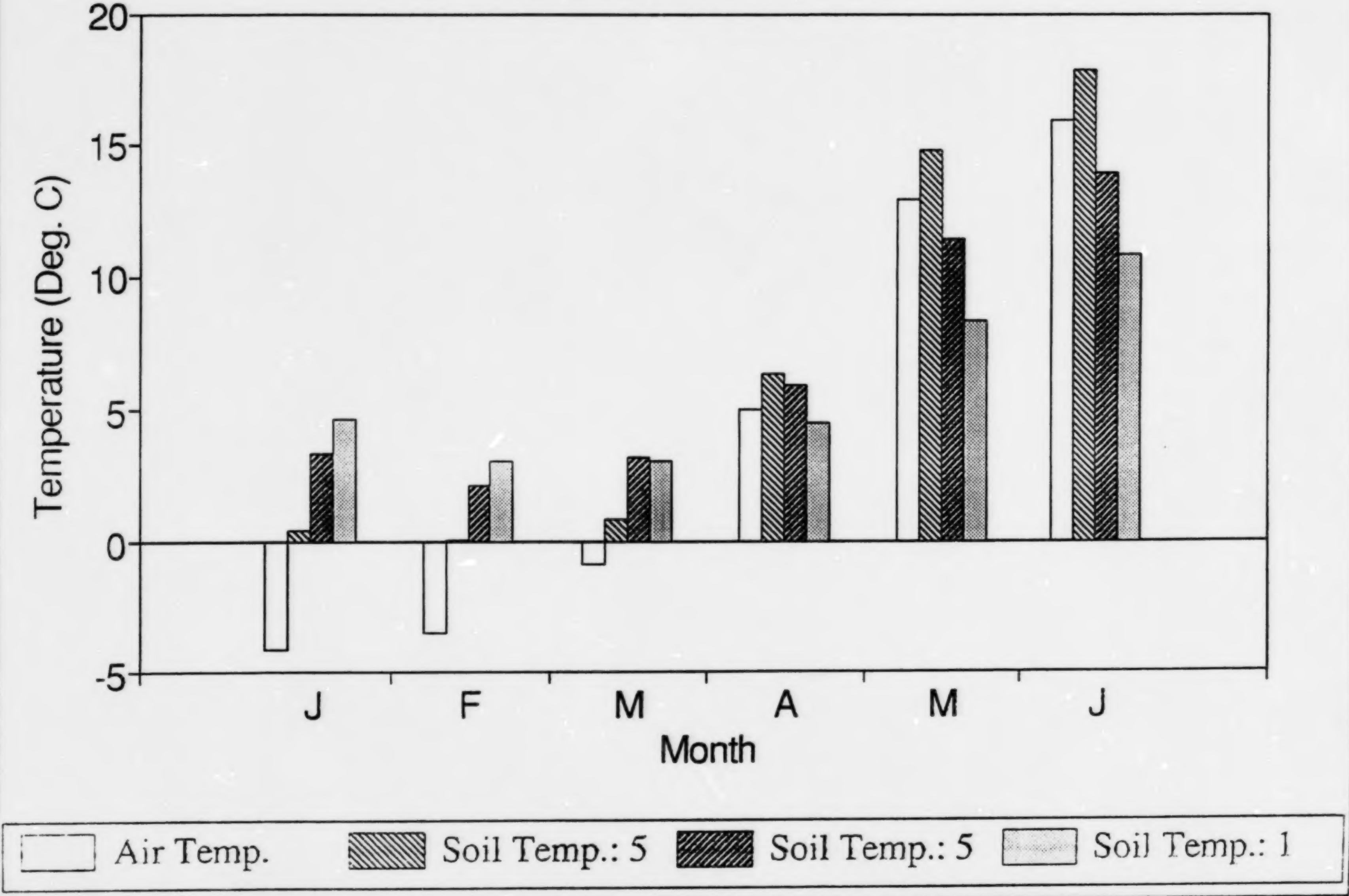
Kettle Creek Watershed

1991 Average Monthly Temperatures



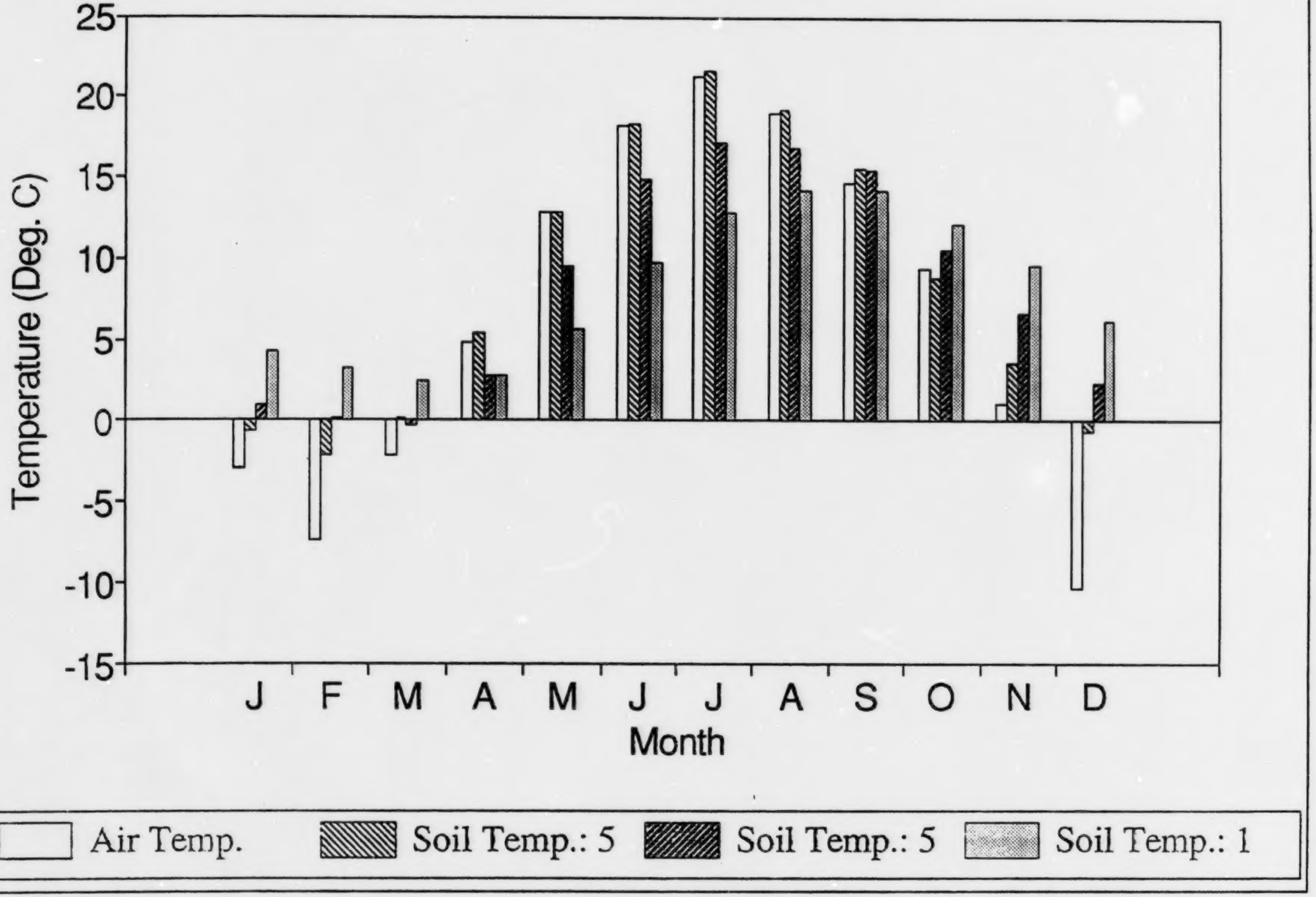
Kettle Creek Watershed

1992 Average Monthly Temperatures



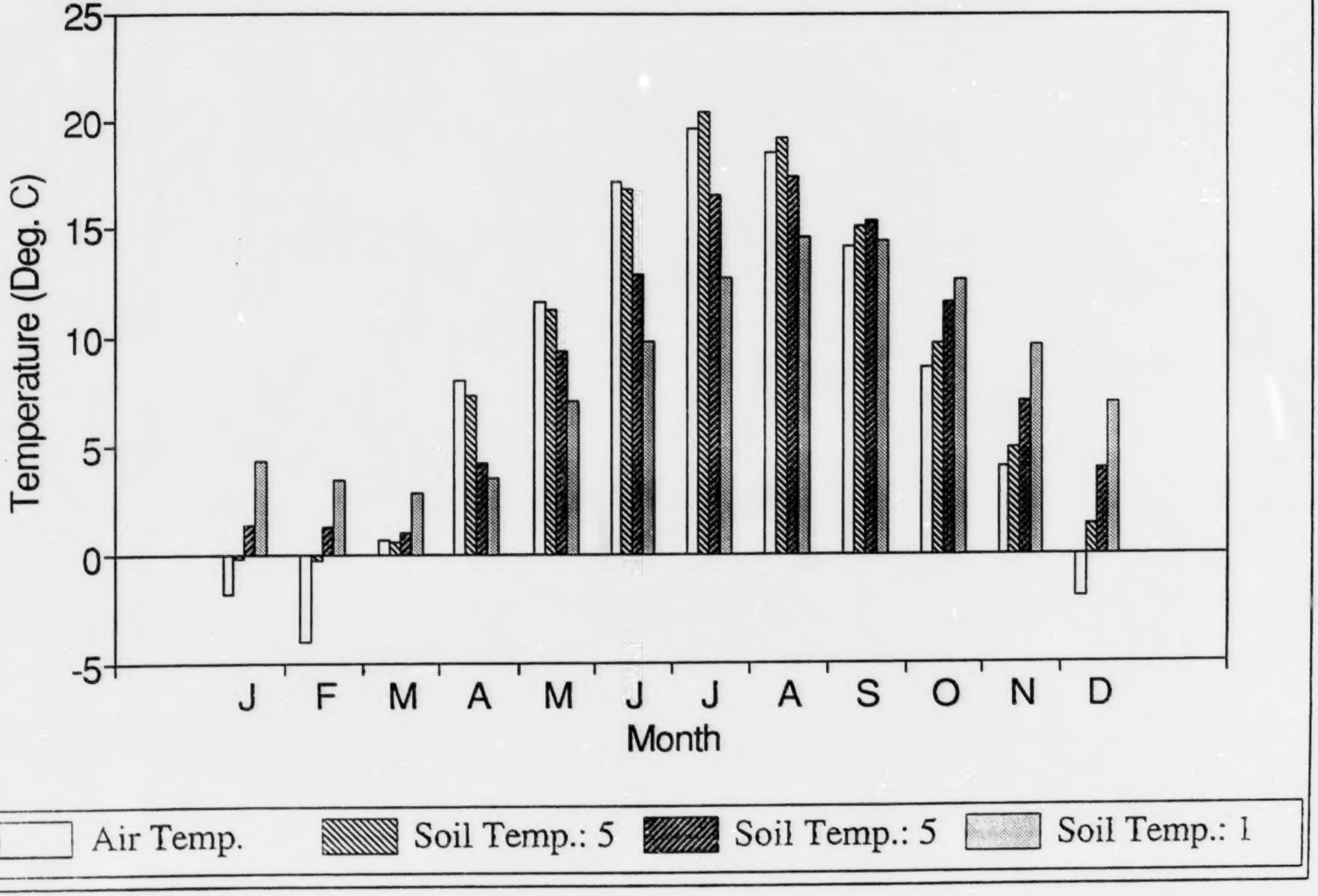
Pittock Watershed

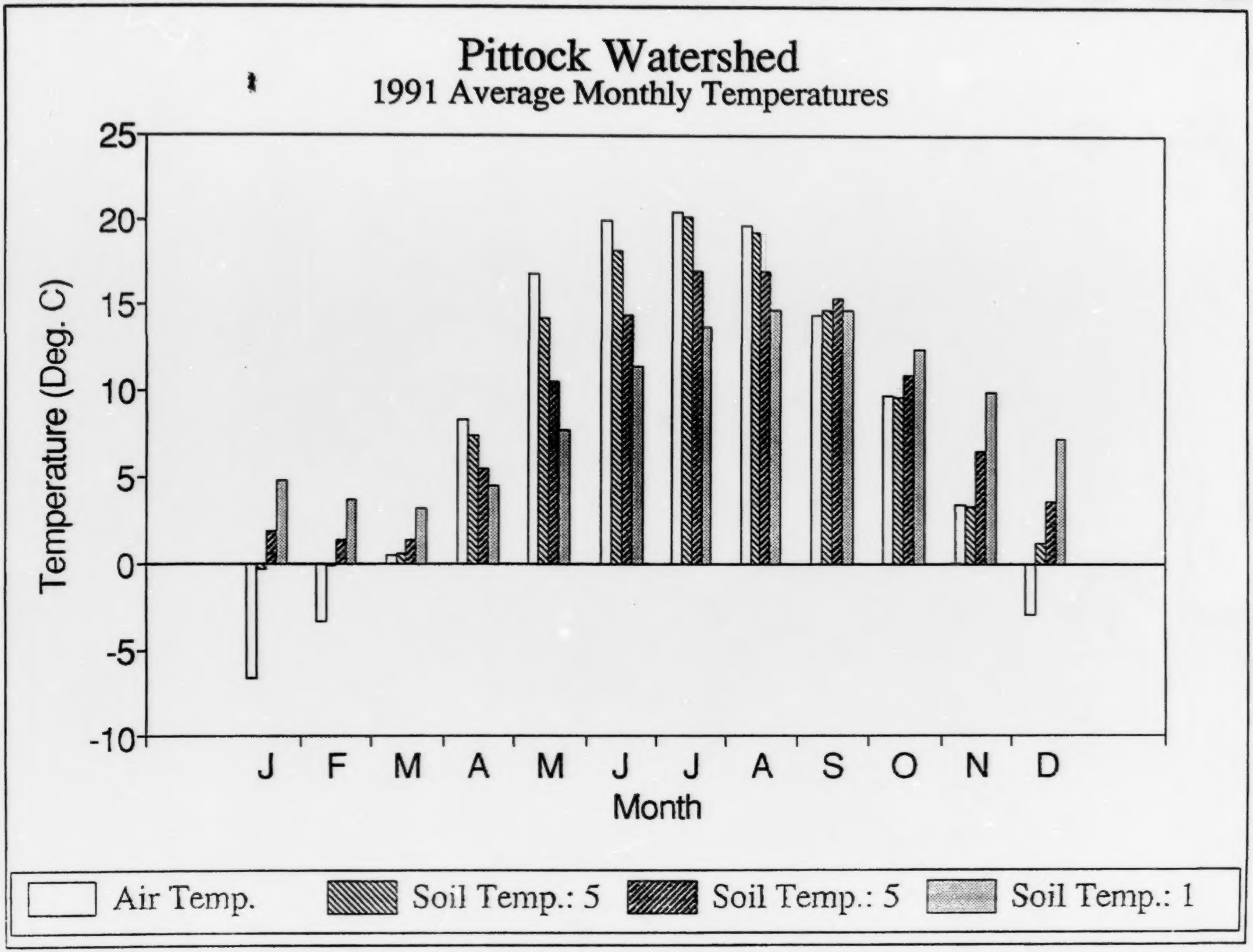
1989 Average Monthly Temperatures

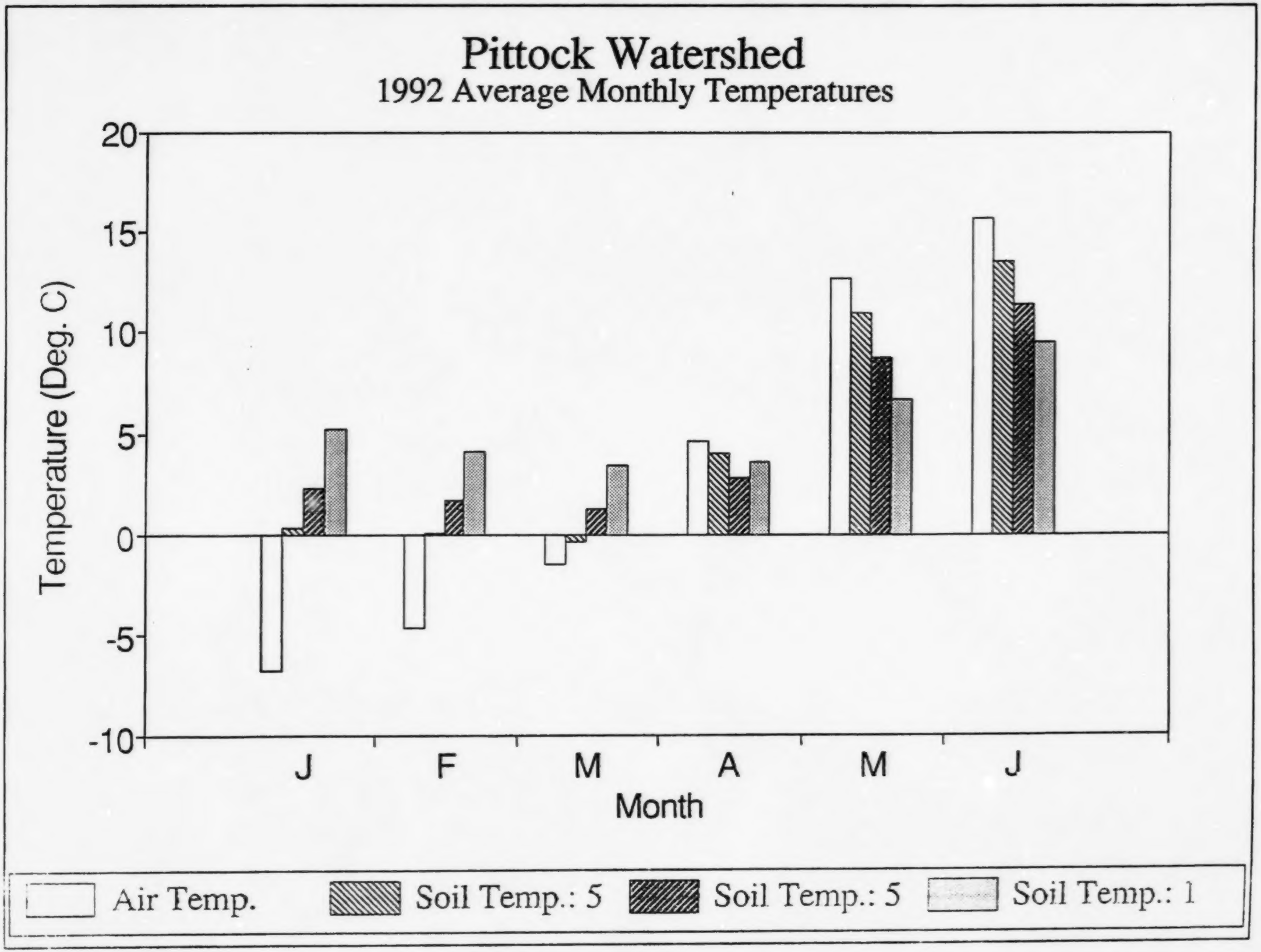


Pittock Watershed

1990 Average Monthly Temperatures




Pittock Watershed
1991 Average Monthly Temperatures
Temperature (Deg. C)
25
20
15
10
5
0
-5
-10
J
F
M
A
M
J
J
A
S
O
N
D
Month
Air Temp.
Soil Temp.: 5
Soil Temp.: 5
Soil Temp.: 1

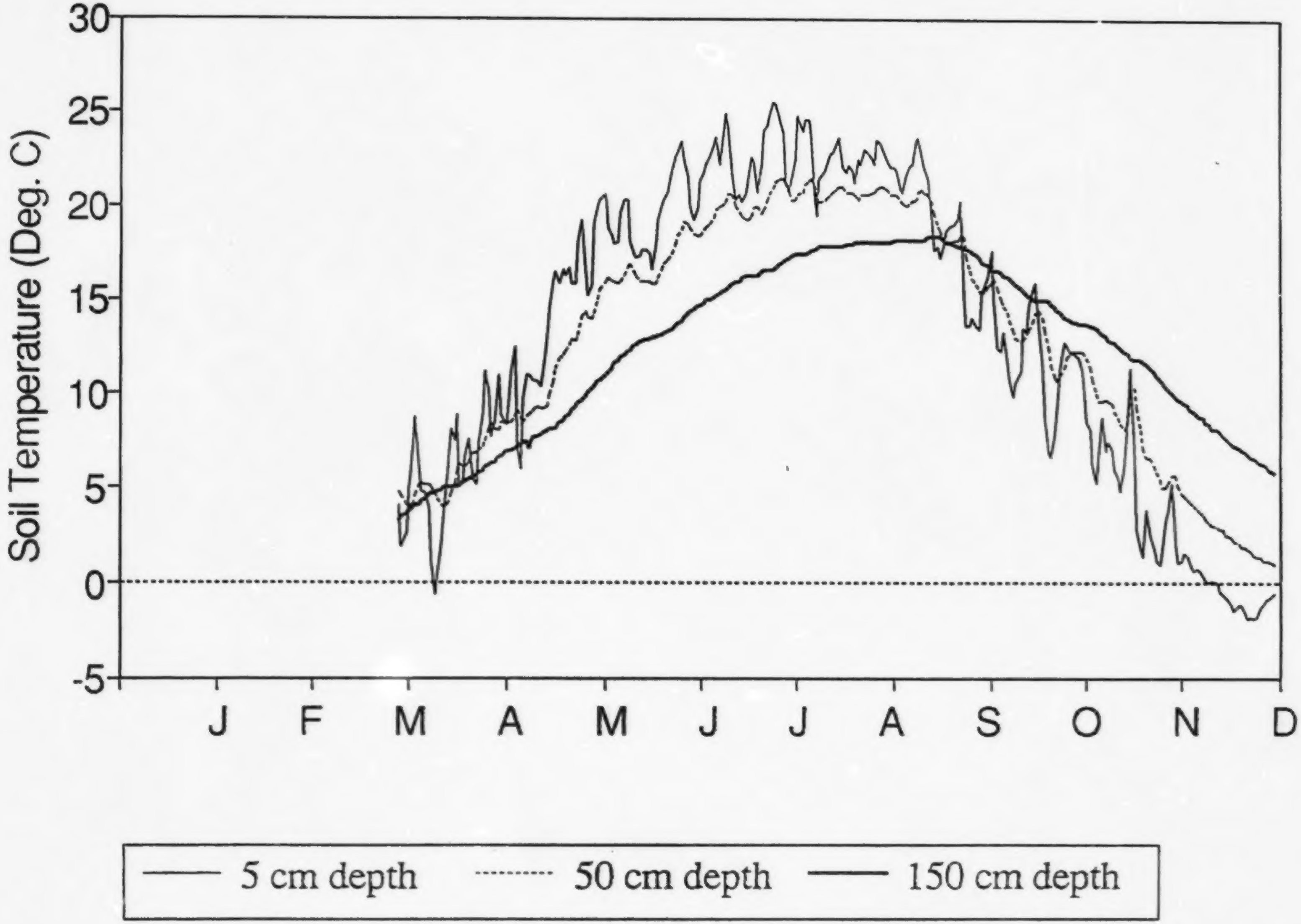


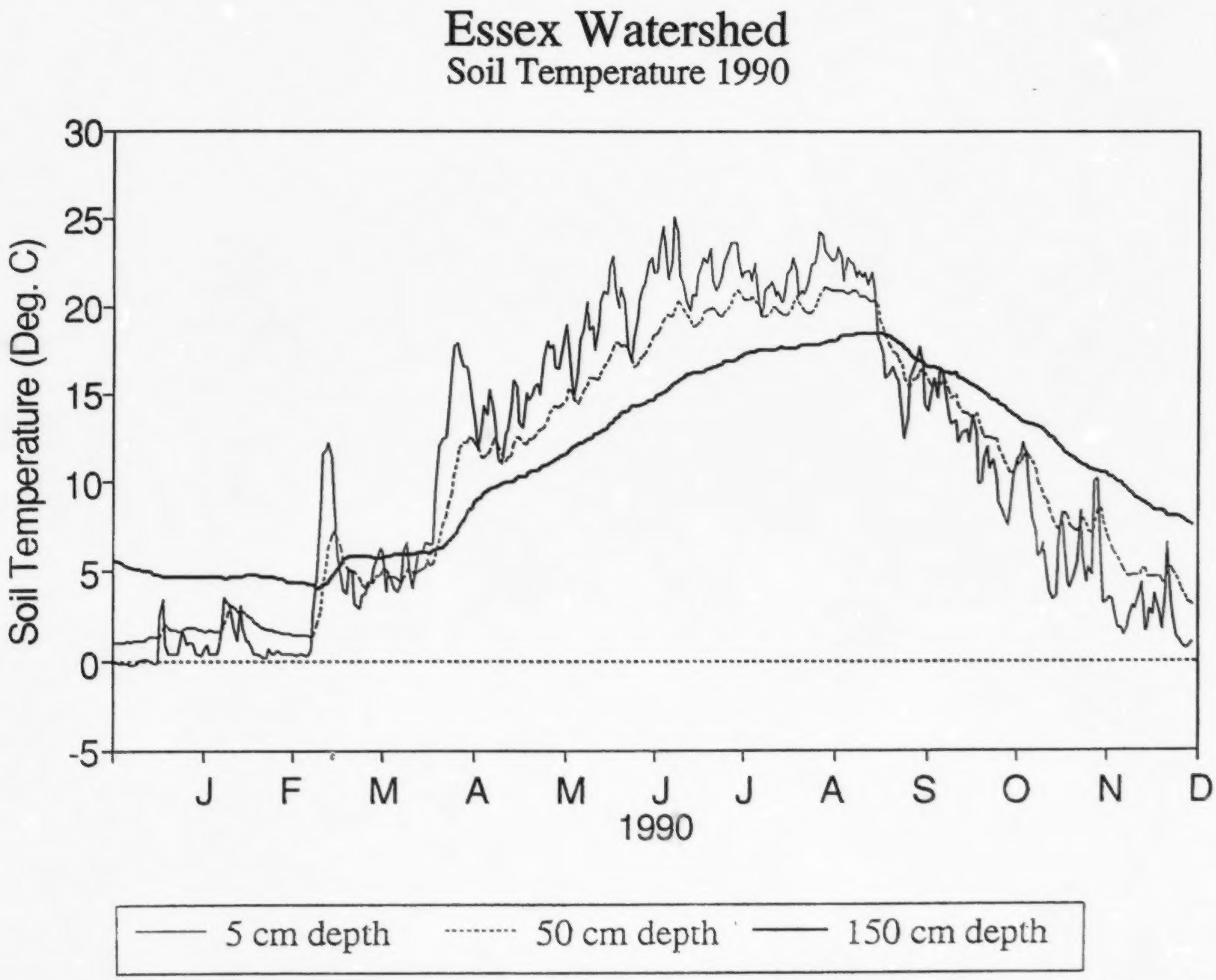
Pittock Watershed

1992 Average Monthly Temperatures

Essex Watershed

Soil Temperature 1989

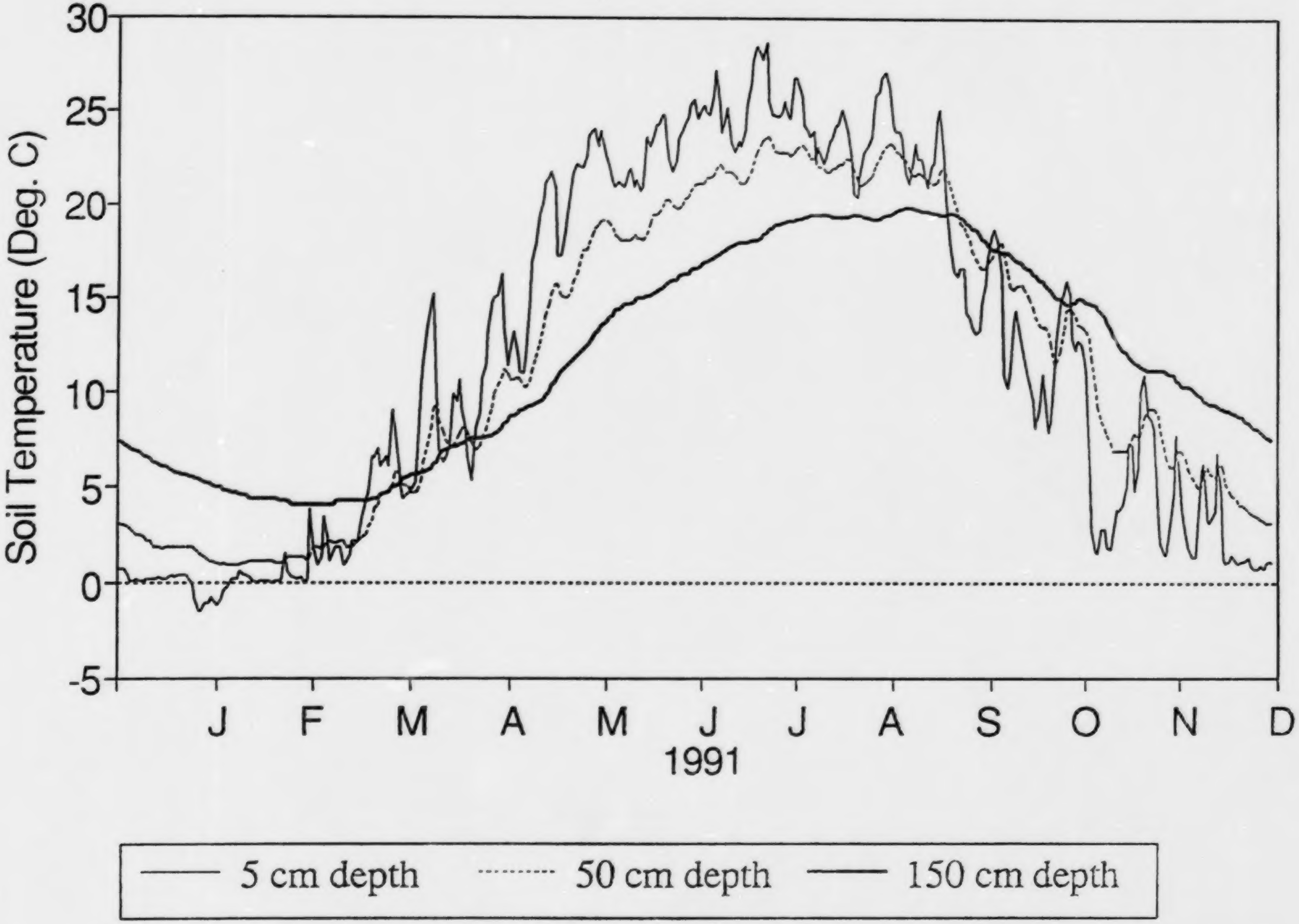




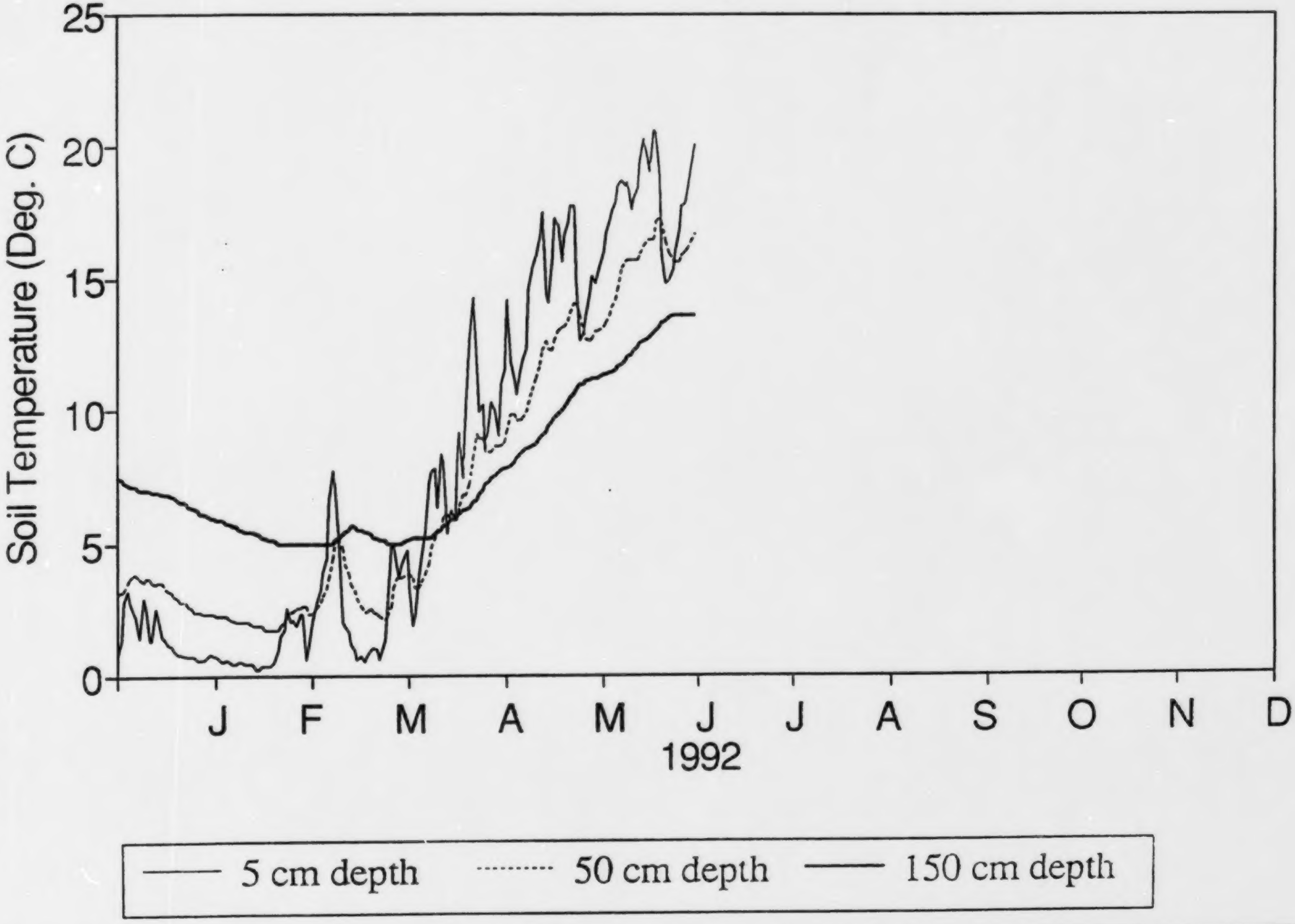
Essex Watershed
Soil Temperature 1990

Essex Watershed

Soil Temperature 1991

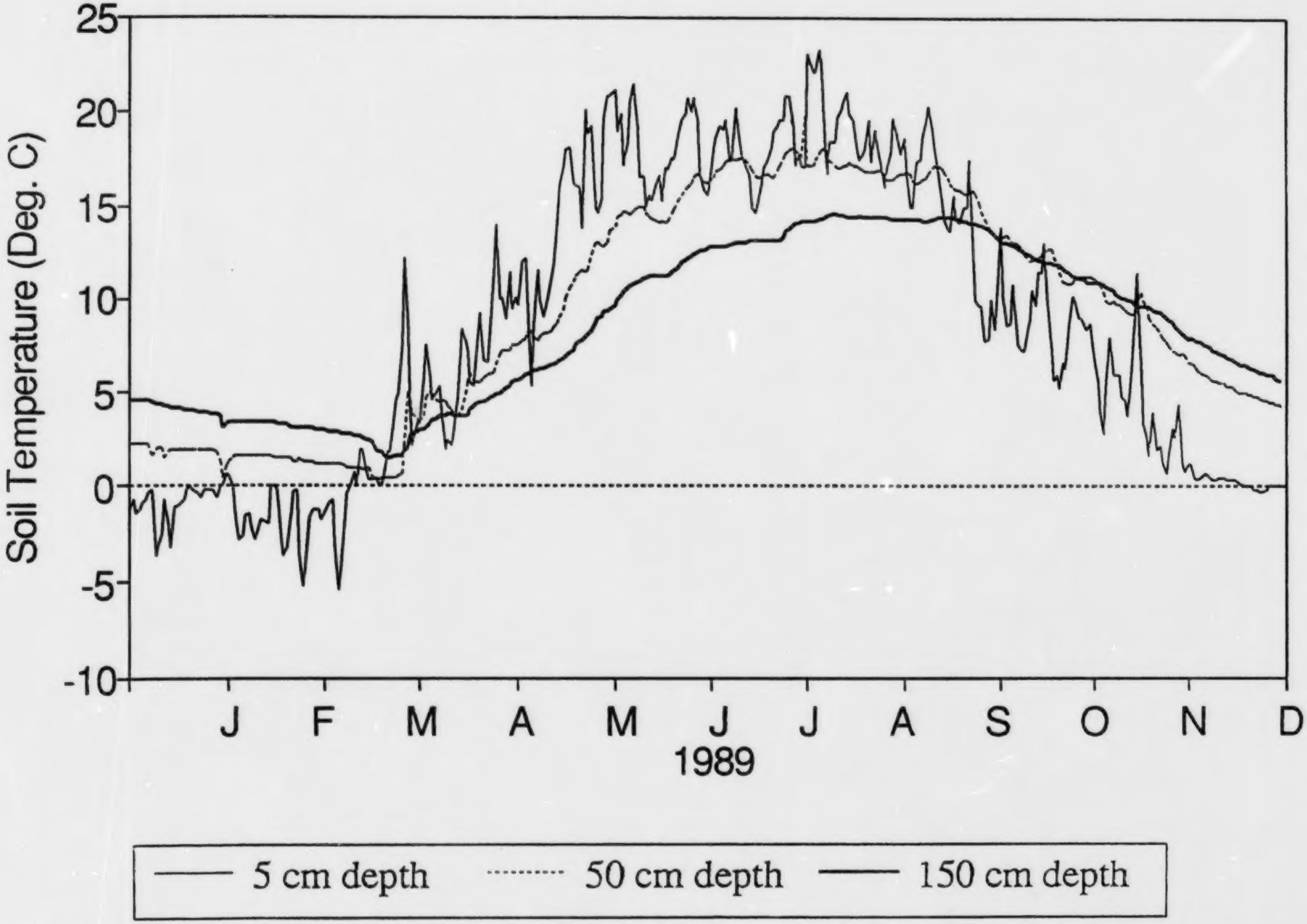


Essex Watershed
Soil Temperature 1992



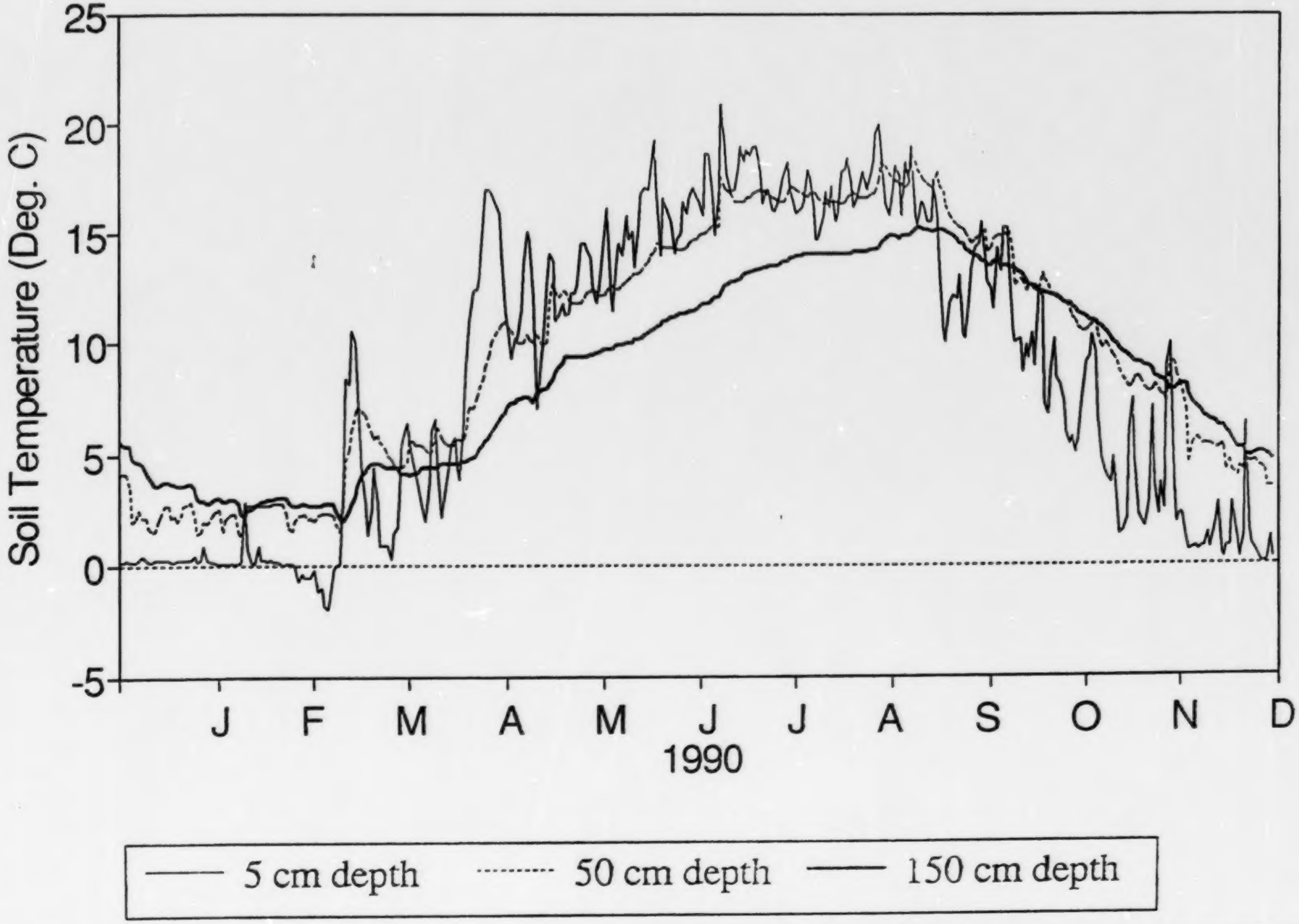
Kettle Creek Watershed

Soil Temperature 1989



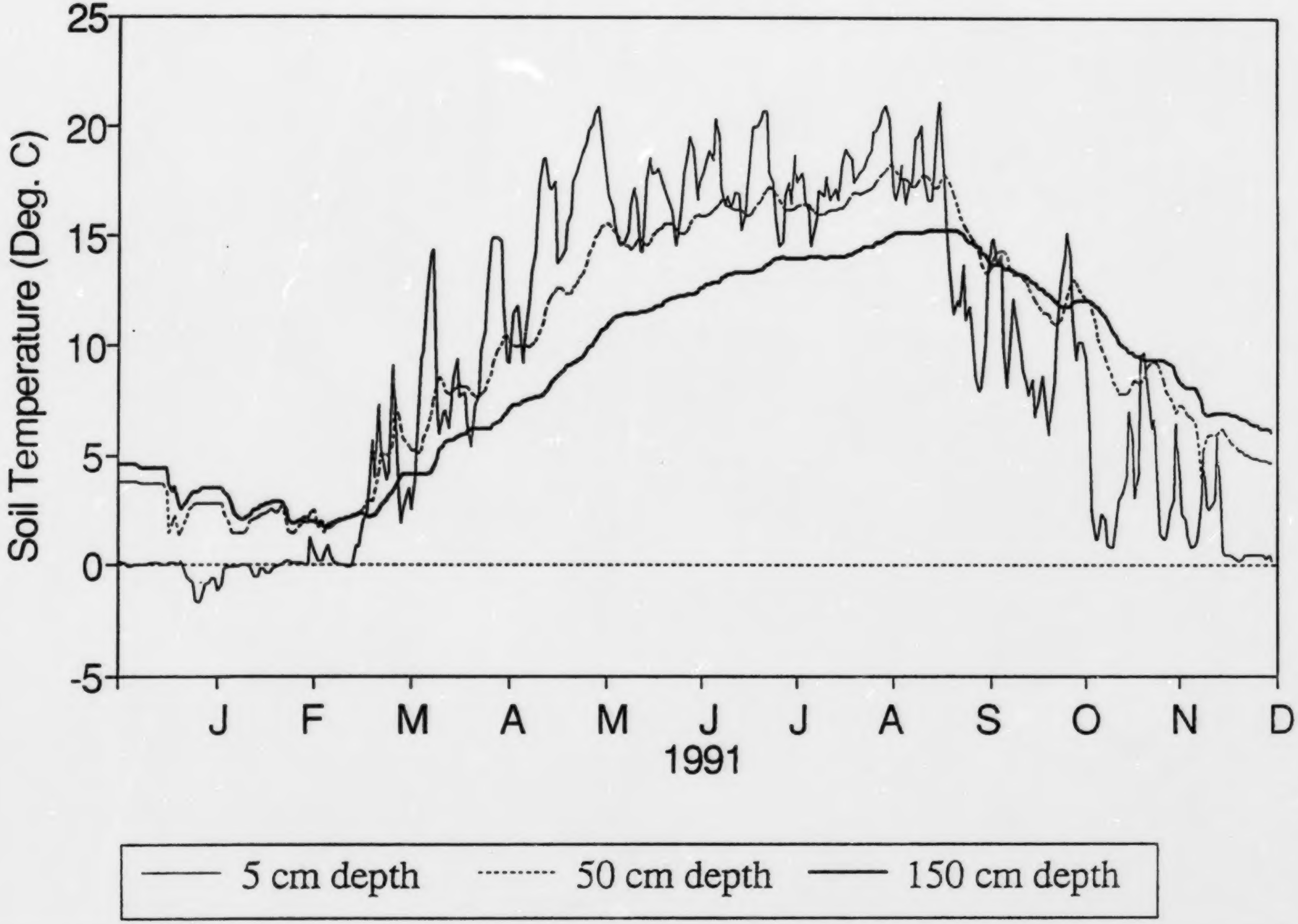
Kettle Creek Watershed

Soil Temperature 1990

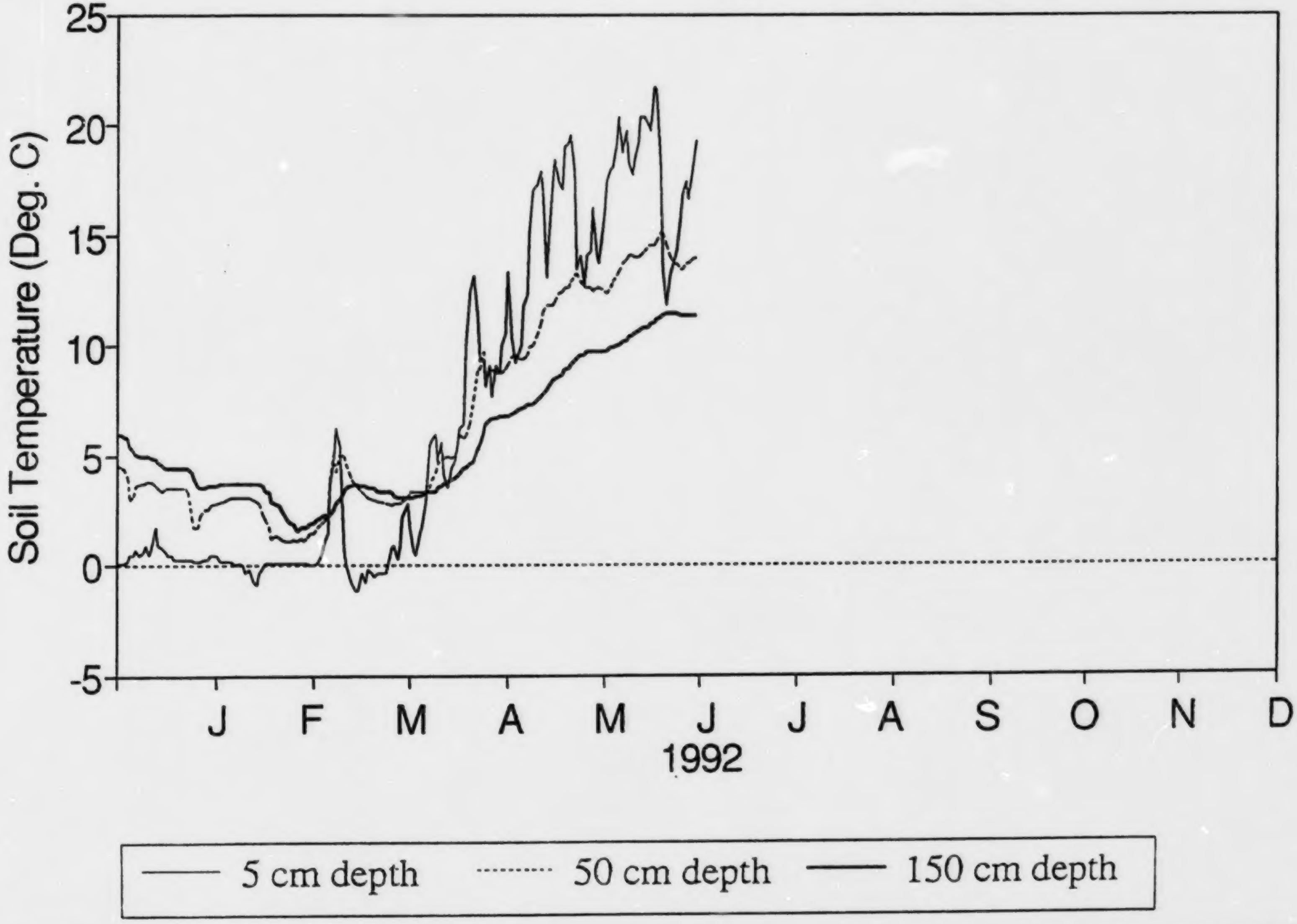


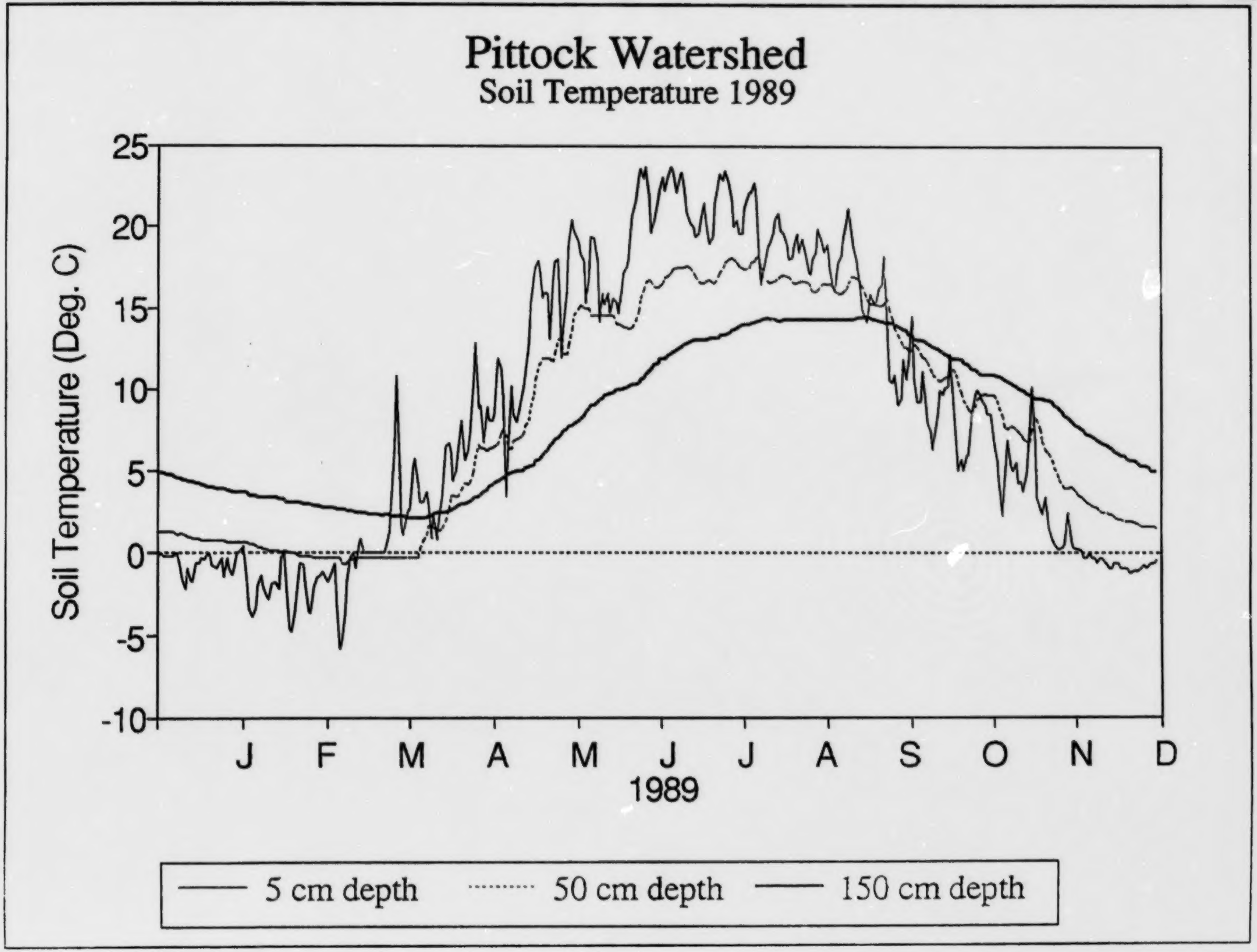
Kettle Creek Watershed

Soil Temperature 1991



Kettle Creek Watershed
Soil Temperature 1992



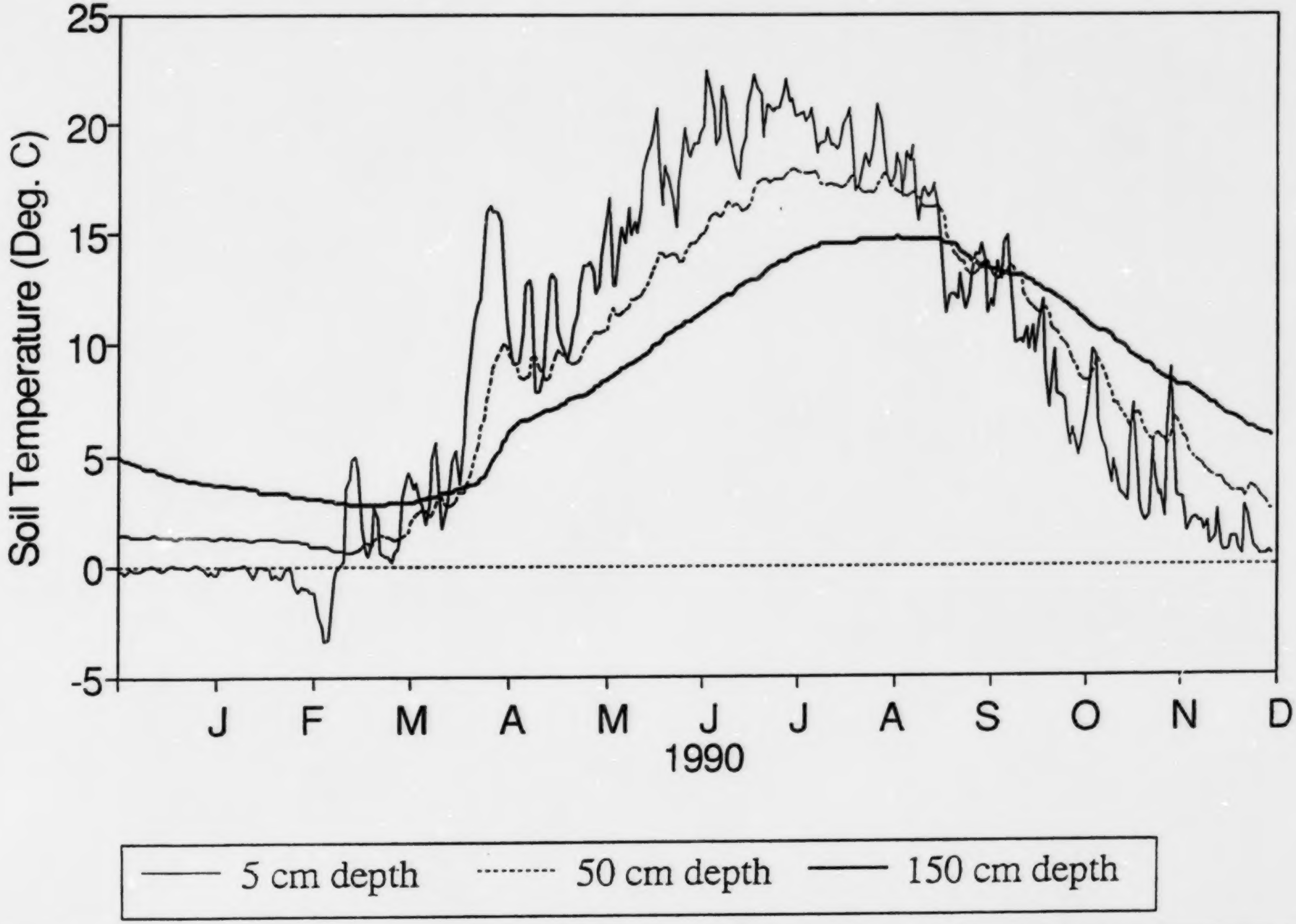


Pittock Watershed

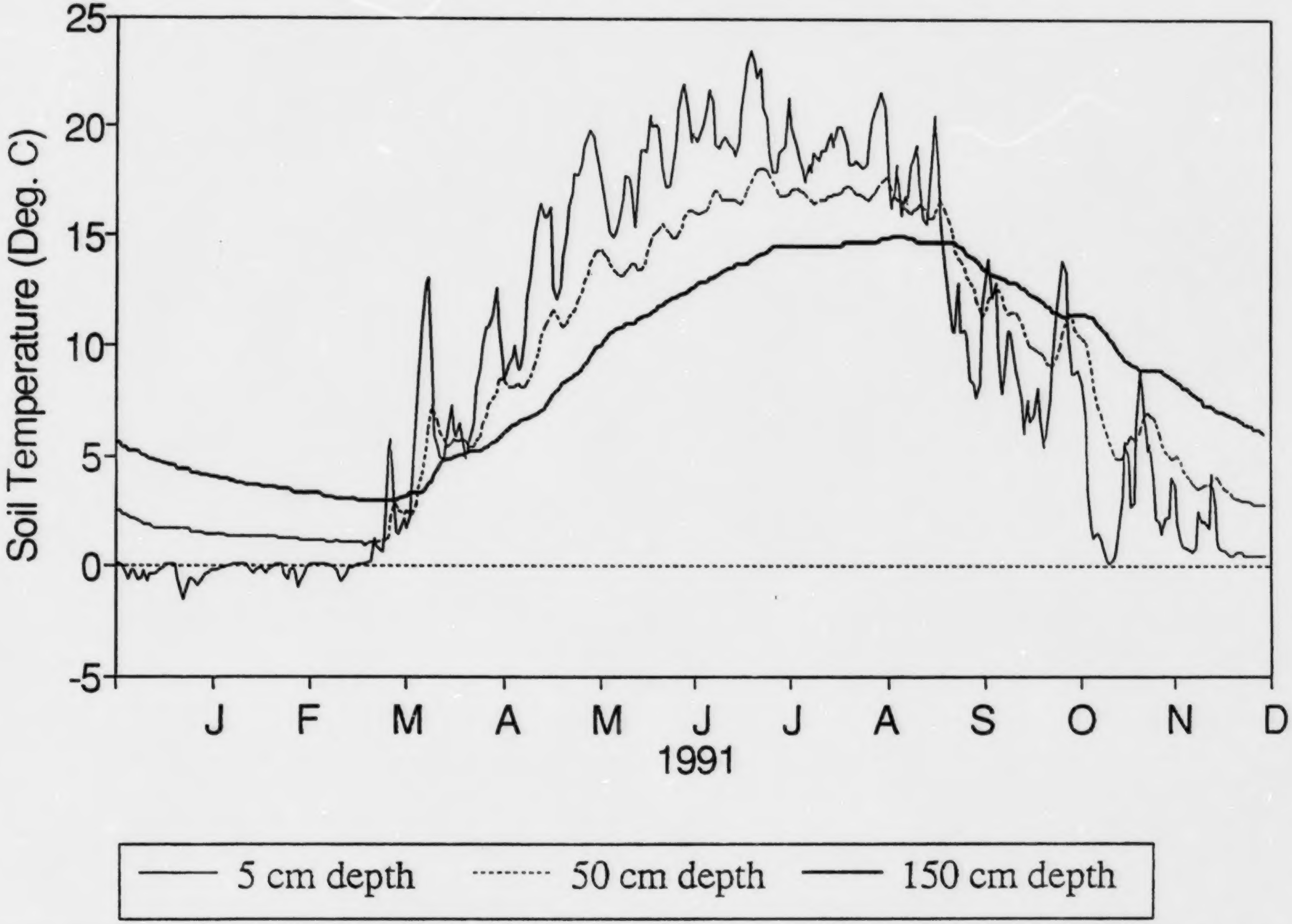
Soil Temperature 1989

Pittock Watershed

Soil Temperature 1990

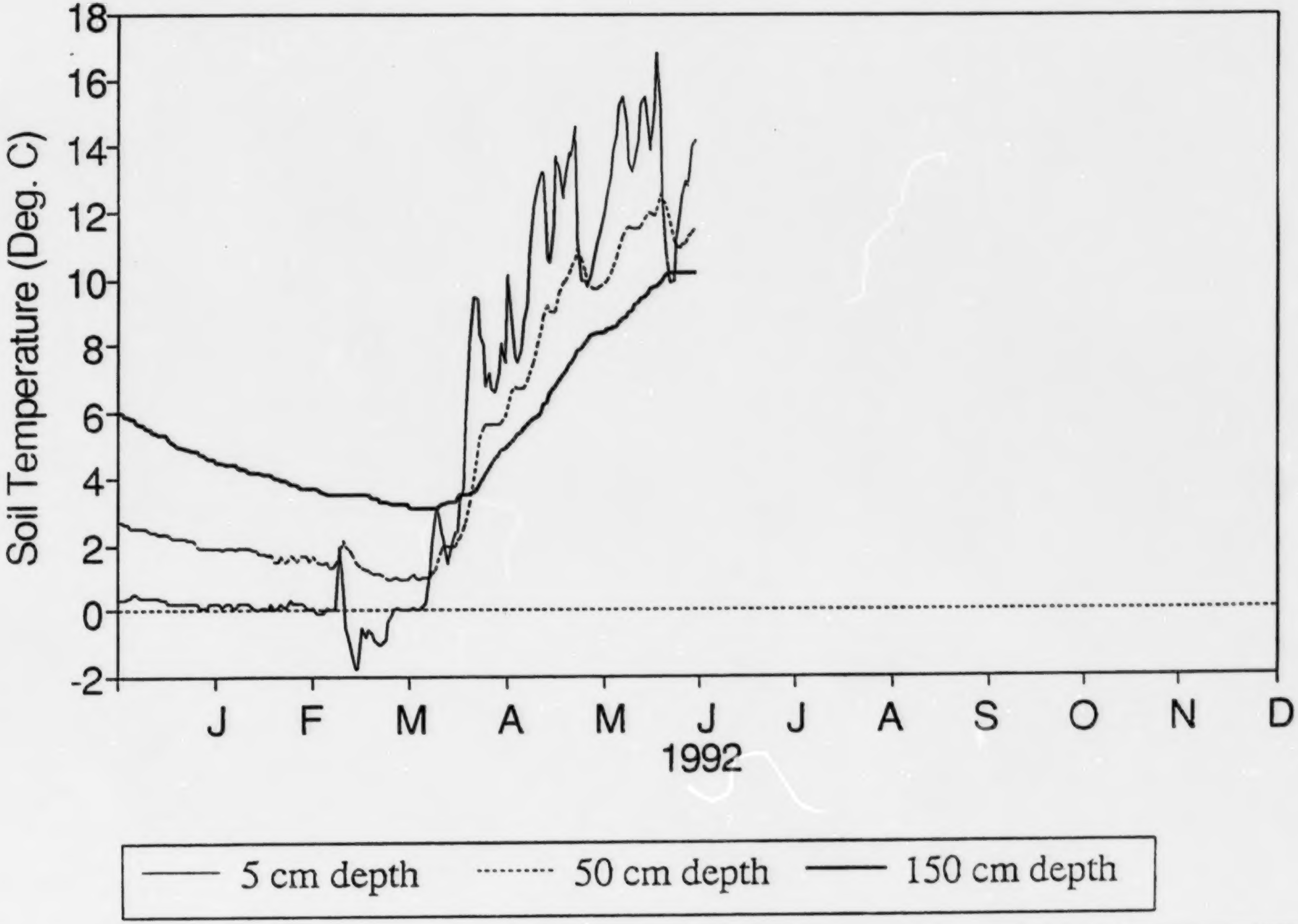


Pittock Watershed
Soil Temperature 1991



Pittock Watershed

Soil Temperature 1992



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                                    ESSEX PRECIPITATION (mm)

                           Annual data display: Summary for period ending 1989/12

  Day        JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

    1       0.00      0.00      0.00      0.00      0.00      5.02      0.00      0.00     14.02      0.00      0.00      0.00
    2       0.00      0.00      0.00      6.80      0.52      6.80      0.00      0.00      0.00      0.21      0.63      0.00
    3       0.52      0.00      0.00     12.87      0.00     15.90      0.00      0.00      0.00      0.00      0.00      0.00
    4       0.00      0.00      3.14      9.52      1.36      0.00      0.00      9.73      0.00      0.00      0.00      0.00
    5       0.00      0.00      1.57      0.00      0.94      0.00      0.00      0.10      0.00      0.84      1.57      0.52

    6       0.00      0.00      0.00      0.00      1.26      0.00      0.00      0.00      1.15      0.00      0.00      0.00
    7      11.51      0.00      0.00      0.73      0.00      0.00      0.00      0.00     11.72      0.00      9.83      0.00
    8       4.18      0.00      0.00      1.15      0.00      0.00      0.00      0.00      9.83      0.00      1.99      0.00
    9       0.00      0.00      0.00      0.00      0.00      0.63      0.00      0.00     10.04      0.00      0.10      0.00
   10       0.00      0.00      0.26      0.00      0.31      0.00      0.00      0.00      1.88     14.33      5.23      0.00

   11       0.00      0.00      1.83      0.00      0.94      0.00      0.00      0.00      0.00      0.00      0.00      0.00
   12       2.09      0.00      0.26      7.32      7.53      6.49      1.88      0.00      0.00      0.00      0.00      0.00
   13       0.00      1.57      2.88      0.00      0.00      0.00      0.00      0.00      1.26      0.00      0.00      0.00
   14       0.00      0.00      3.14      1.57      0.00      0.10      0.84      0.00      8.58      0.00      4.50      0.00
   15       1.57      0.00      0.52      3.45      0.00     19.77      0.00      1.36      0.00      0.00     27.93      0.00

   16       0.52      0.00      1.31      0.00      0.00      1.99      0.00      0.00     17.68      0.00      3.03      0.00
   17       0.00      0.00      0.52     18.51      0.00     10.25      0.00      0.00      1.67      4.71      0.00      0.00
   18       0.00      0.00      0.00      0.00      0.00      0.10      0.00      0.00      0.10      0.00      0.00      0.00
   19       0.00      0.00      0.78      0.00      0.10     38.81     46.86      0.00      0.00     10.77      0.00      0.00
   20       0.00      2.09      1.31      0.00      9.20      0.00     31.69      4.50      0.00      3.66      0.00      0.00

   21       0.00      7.32      0.52      4.60      0.00      0.00      0.00      0.00      0.10      0.63      0.00      0.00
   22       0.00      0.00      1.57      0.00      0.00      0.10      0.00      2.20      7.11      0.00      0.00      0.00
   23       0.00      0.00      1.83      0.00      1.99      0.00      7.01      0.10      0.00      0.00      0.00      0.00
   24       0.00      0.00      1.57      0.00      0.00      9.41      0.00      0.00      0.00      0.00      0.00      0.00
   25       5.23      0.00      1.83      6.17     35.98      0.00      0.00      0.00      0.00      0.00      0.00      0.00

   26       4.18      1.57      2.09      0.21      7.11     13.91      0.00      0.00      0.00      0.00      0.00      0.00
   27       0.00      0.00      2.35      0.00      0.00      1.46      1.57      0.00      0.00      0.00      9.00      0.00
   28       0.00      0.00      2.09      0.00      0.00      0.00      0.10     18.62      0.00      0.00      0.00      0.00
   29       1.05                0.26      0.00      0.00      0.00      0.00      0.21      0.00      0.00      0.00      0.00
   30       0.52                0.78      0.00     30.65      0.00      1.15      0.00      0.00      0.00      0.00      0.00
   31       0.00                0.78               26.15                0.00      0.00                5.13               25.63
0 SUM      31.38     12.55     33.21     72.91    124.06    130.75     91.11     36.82     85.14     40.27     63.81     26.15

  SUM  of monthly values  7.48151E+02
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                                    ESSEX PRECIPITATION (mm)

                           Annual data display: Summary for period ending 1990/12

  Day        JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

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    3       0.00      0.00      0.00      0.20      0.00     11.41      0.00      0.00      0.00      0.20      0.00      4.55
    4      13.13      0.00      0.00      0.20     26.66      0.00      0.00      4.14      0.00     10.71      5.35      0.00
    5       0.00      0.00      0.00      1.41      1.92      0.00      0.00      0.00      0.00      0.00     21.51      0.00

    6       0.00      0.00      0.00      0.00      0.10      0.00      0.00      0.00     65.65      0.00      0.00      0.00
    7       0.00      0.00      0.00      0.50      0.00      0.00      0.00      0.00     21.41      5.86      0.10      0.00
    8       0.00      0.00      0.00      0.00      0.00     23.33      0.00      0.00      0.00      4.44      0.00      0.00
    9       5.05      2.02      1.26      2.32      0.00      0.00      0.00      0.00      0.20     27.57      3.03      0.00
   10       0.20      0.00      0.00     22.32      4.44      0.10      0.00      0.00      4.44     17.88      0.00      0.00

   11       0.00      0.00      1.77      0.00      0.00      0.00      2.32      8.48      0.10      0.00      0.00      0.00
   12       0.00      0.00      0.00      0.20      3.64      0.00      0.00     35.45      0.00      2.22      0.00      0.00
   13       0.00      1.26      0.00      0.00     27.37      0.00      2.83     25.65      0.00      0.10      0.00      0.00
   14       0.00      0.00      0.00      7.68      0.61      2.52     31.41      0.00     24.24      0.10      0.00      0.00
   15       0.00      0.00      0.00      0.00      4.75      0.00      0.00      0.00      0.30      0.00      0.00      2.53

   16       0.00      0.00      1.77      0.40     17.57      0.00      0.81      0.00     19.29      0.00      0.10      0.00
   17      15.45      0.00      0.00      0.40      5.76      0.00      0.00      0.00      0.00      0.00      0.00      1.51
   18       1.31      0.00      0.00      0.00      0.00      0.00      7.37     32.22      0.61     13.94      0.00      6.06
   19       0.00      0.00      0.00      0.00      0.91      0.00      0.00      8.08     21.11      0.00      0.00      0.00
   20       0.00      0.00      0.00     14.14      1.62      0.50      3.84      0.20      0.00      0.00      0.10      0.00

   21       0.00      0.00      0.00      0.30      0.10      0.10      0.20      4.14      8.99      0.10      0.10      9.09
   22       0.00     58.18      0.00      0.00      0.00      5.25     10.50      0.00      0.00      0.50     12.42      2.53
   23       0.40      1.21      0.00      0.00      0.00      5.05      0.00      0.10      0.00      0.10      1.41      2.53
   24       0.00      0.00      0.00      0.00      0.00      1.51      0.00      0.00      0.00      0.00      0.00      0.00
   25       2.83      0.00      0.00      0.00      2.12      0.00      0.00      0.00      0.00      0.00      0.00      0.00

   26       0.00      0.00      0.00      0.00      0.30      0.00      0.00      0.00      0.00      0.00      4.55      0.00
   27       0.00      0.00      0.00      0.00      0.00      2.22      0.00      0.00      0.00      0.00      2.02      0.00
   28       0.00      0.00      0.00      0.00      0.00     15.45      0.00     14.95      0.50      0.00      5.35      1.01
   29       0.00                1.01      0.00      0.00      0.10      0.00      0.00      0.10      0.00      0.00     23.23
   30       0.00                1.26      0.00      0.00      5.76     22.83      0.00      0.91      0.00      0.00     15.66
   31       0.00                0.50                0.00                0.00      0.00                0.00                0.00
0 SUM      38.38     73.53      7.58     59.08     97.87     82.92     82.11    133.42    167.86     83.73     56.06     68.68

  SUM  of monthly values  9.51218E+02
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ESSEX PRECIPITATION (mm)

Annual data display: Summary for period ending 1991/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.00	0.00	0.51	0.00	5.12	0.00	0.82	0.00	0.00	0.00	6.86	0.00
2	0.00	0.00	2.30	0.00	0.00	4.92	0.82	0.00	0.00	0.00	0.00	0.10
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.07	16.59	1.64	0.00	7.88
4	0.00	0.00	0.00	4.81	0.00	0.00	1.54	0.00	0.10	25.29	0.00	0.00
5	0.00	0.00	0.00	0.41	6.14	0.00	0.00	0.00	0.00	0.10	0.00	0.61
6	0.00	0.00	2.05	0.00	0.31	0.00	0.00	0.00	0.00	0.31	0.00	0.10
7	0.00	0.00	0.00	0.00	0.00	0.00	8.09	0.00	0.00	0.00	0.00	0.51
8	0.00	0.26	0.00	11.88	0.00	0.00	0.00	24.17	0.00	0.00	0.20	0.20
9	0.00	0.00	0.00	3.99	1.02	0.00	0.00	1.33	5.02	0.00	0.10	3.99
10	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00	0.00	9.42	0.00	0.00
11	0.00	0.00	0.26	0.00	0.00	2.66	0.00	0.00	0.00	0.10	0.00	0.00
12	0.00	0.00	0.00	0.00	0.31	0.00	0.31	0.00	0.00	0.92	1.54	2.76
13	0.00	0.00	0.00	0.82	7.17	0.00	0.00	0.00	0.00	0.00	0.00	0.10
14	0.00	2.30	0.00	4.61	0.10	0.00	0.00	0.00	0.00	2.56	1.43	0.31
15	0.26	0.00	0.00	1.23	0.00	19.76	0.00	0.00	0.00	0.00	3.58	0.10
16	4.61	0.00	0.00	0.00	3.17	0.00	0.00	0.00	0.00	0.00	0.41	0.00
17	0.00	0.00	1.28	0.00	2.25	0.00	0.00	4.10	0.00	0.00	0.10	0.00
18	0.00	0.26	2.05	0.00	0.00	0.00	0.00	0.00	0.00	2.36	6.25	0.00
19	0.00	0.77	0.00	24.37	0.00	0.00	0.00	14.13	0.00	6.25	4.51	0.00
20	1.28	0.00	0.00	11.67	0.00	0.00	0.00	13.21	0.00	0.00	22.32	1.95
21	0.00	0.00	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.72	0.10
22	0.00	0.00	0.00	0.00	0.00	4.92	0.00	1.13	3.38	0.31	0.00	0.00
23	0.00	0.00	0.00	3.58	0.00	0.00	0.00	0.00	2.36	0.00	3.89	0.82
24	0.00	0.00	0.00	2.66	6.45	0.00	0.00	0.00	0.00	21.81	0.00	0.00
25	0.00	0.00	0.00	0.00	9.01	0.00	0.00	0.00	0.61	37.68	0.00	0.00
26	0.00	0.00	0.00	0.00	22.53	0.00	0.00	0.00	0.00	11.57	0.00	0.00
27	0.00	0.00	1.28	0.00	0.00	0.00	0.00	0.00	0.00	10.34	0.92	0.00
28	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.10	3.69	1.74
29	0.00		0.00	0.20	0.00	0.00	0.41	0.00	0.00	0.00	5.12	4.81
30	0.00		0.00	0.00	10.34	0.00	0.00	0.82	0.00	7.17	1.43	0.00
31	0.00		1.28		35.33		0.00	0.00		0.10		0.00
SUM	6.14	3.58	11.01	71.27	109.88	33.08	11.98	61.95	28.06	138.04	63.08	26.11

SUM of monthly values 5.64173E+02

ESSEX PRECIPITATION (mm)

Annual data display: Summary for period ending 1992/ 6

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.00	0.10	0.00	3.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.95	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.20	0.51	1.23	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.72	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	7.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	14.03	3.07	0.00	6.25	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.51	0.00	0.00	0.31	3.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	9.22	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	3.07	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	2.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	18.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	1.95	0.00	17.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	1.54	0.10	5.43	31.54	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	9.93	0.00	7.48	0.00	4.61	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	1.95	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.20	0.00	2.97	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00
21	1.13	0.00	0.00	12.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.10	2.05	0.00	0.31	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00
23	1.23	0.00	0.00	12.49	12.49	5.94	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	8.60	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	3.48	2.87	3.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	4.20	0.00	0.00	8.60	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	8.81	0.00	0.00	0.10	0.00	0.	0.00	0.00	0.00	0.00
28	0.00	5.73	0.00	0.00	0.00	0.00	0.00	0.	.00	0.00	0.00	0.00
29	0.00	0.00	0.72	6.04	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00		2.56	3.38	12.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00		4.20		0.00		0.00	0.00		0.00		0.00
0 SUM	11.26	44.03	56.42	86.73	35.33	60.62	0.00	0.00	0.00	0.00	0.00	0.00

SUM of monthly values 2.94400E+02

KETTLE CK. PRECIPITATION mm.

Annual data display: Summary for period ending 1989/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	19.72	0.40	0.00	0.00
2	0.00	0.00	0.00	5.45	0.79	11.69	0.00	0.00	0.00	0.99	1.68	0.00
3	0.00	0.00	0.00	11.00	0.00	10.90	0.00	0.00	0.00	0.00	0.10	0.00
4	0.00	0.00	2.48	4.76	0.00	0.10	10.80	0.69	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	4.06	6.94	0.00	0.00	0.00	0.00	1.49	6.94	0.00
6	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.10	0.40	2.38	4.71
7	1.24	0.00	0.00	0.00	1.59	0.00	0.00	0.00	0.40	0.30	17.64	0.00
8	2.23	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.89	0.00	5.25	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	2.18	0.00
10	0.00	0.00	0.00	0.00	0.79	0.00	0.00	3.77	0.10	23.59	1.39	0.00
11	0.00	0.00	0.00	0.10	4.86	0.00	0.00	0.00	0.00	0.10	0.40	0.00
12	3.47	0.00	0.00	6.44	10.90	8.03	0.00	0.00	0.30	0.00	0.00	0.00
13	0.00	0.50	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	3.47	0.00	0.00	0.59	0.10	0.10	0.00	0.00	6.05	0.00	7.53	0.00
15	0.00	0.00	0.25	11.59	0.00	0.00	0.00	2.08	0.00	0.00	19.72	0.00
16	0.00	0.00	0.00	0.00	0.00	3.17	0.00	0.10	8.42	1.49	6.24	0.00
17	0.00	0.00	12.64	11.99	0.00	10.50	0.00	0.00	0.69	9.02	0.00	0.00
18	0.00	0.00	8.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.10	0.00	19.03	0.40	0.00	0.00	3.47	0.00	0.00
20	1.49	0.00	0.25	0.00	9.12	0.10	11.99	0.00	0.00	13.58	0.10	0.00
21	0.00	1.49	0.00	0.00	0.00	10.70	0.00	0.00	0.00	8.72	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	1.19	0.00	8.72	6.44	0.20	0.00	0.00
23	0.00	0.00	0.00	0.00	9.81	0.00	0.00	0.59	10.21	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.99	0.00	0.00	0.00	21.80	0.00	45.59	0.00	0.00	0.10	0.00	0.00
26	4.95	0.00	0.00	3.17	7.53	3.27	0.20	0.00	0.00	0.00	0.69	0.00
27	0.00	0.00	0.50	0.00	0.00	1.19	2.48	0.00	0.00	0.00	5.85	0.00
28	0.00	0.00	1.49	0.00	0.00	0.00	0.00	1.19	0.00	0.00	0.40	0.00
29	1.49		0.00	0.00	0.00	0.00	0.00	10.01	0.00	0.00	0.00	0.00
30	0.00		0.00	0.00	9.41	0.00	1.29	0.00	0.00	0.00	0.00	0.00
31	0.00		0.00		7.53		0.00	0.00		0.59		19.82
0 SUM	19.32	1.98	26.26	60.25	91.17	80.17	72.74	27.25	53.41	64.42	78.49	24.53

SUM of monthly values 6.00001E+02

KETTLE CK. PRECIPITATION mm.

Annual data display: Summary for period ending 1990/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.00	4.38	0.00	2.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	7.21	0.00	0.58	0.00	0.00	0.00	0.10	0.00	0.00
3	0.00	0.00	0.00	0.39	0.00	15.88	0.00	0.00	0.00	0.00	0.00	18.26
4	16.07	0.00	0.00	0.00	12.95	0.29	0.00	7.60	0.00	14.22	4.48	0.00
5	0.00	0.00	0.00	2.63	1.17	0.00	0.29	0.49	0.00	0.00	44.80	0.00
6	0.00	11.44	0.00	0.00	0.00	0.58	0.00	0.00	30.00	0.00	0.49	0.00
7	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00	10.13	0.00	1.46	0.00
8	0.00	0.00	0.00	0.00	0.00	21.62	25.71	0.00	0.00	0.49	0.00	0.00
9	4.63	5.11	5.84	0.68	0.00	0.00	16.85	0.00	2.43	25.32	4.48	0.00
10	2.19	0.00	7.40	20.06	2.53	0.00	0.00	0.00	0.19	7.89	0.49	0.00
11	0.49	0.00	4.48	0.10	0.00	0.00	1.66	5.45	0.00	5.45	0.39	0.00
12	0.24	0.00	1.75	0.00	2.48	0.10	0.00	14.90	0.00	12.27	0.00	0.00
13	0.00	1.22	0.00	0.00	28.83	0.00	0.00	15.49	0.00	0.10	0.00	0.00
14	0.00	0.00	0.00	5.06	0.10	0.39	0.00	0.00	33.02	0.00	0.00	0.00
15	0.00	0.00	0.00	0.10	1.66	0.00	32.53	0.00	0.97	0.00	0.00	4.38
16	0.49	3.90	4.09	3.41	26.20	0.00	0.00	0.49	3.99	0.00	1.56	0.00
17	15.34	0.00	0.00	0.97	10.81	0.00	3.70	0.00	0.00	0.00	0.00	1.70
18	6.82	1.46	0.00	0.00	0.00	2.82	0.19	0.10	0.00	18.99	0.00	6.33
19	0.00	0.00	0.00	0.00	3.80	0.00	0.00	10.71	5.94	1.75	0.00	0.00
20	0.00	0.00	0.00	10.13	11.69	1.07	11.69	1.17	0.00	0.00	0.00	0.00
21	1.22	0.00	0.00	0.10	0.00	0.00	0.00	0.00	7.11	0.58	0.68	6.82
22	1.46	56.10	8.57	0.00	0.00	6.33	7.50	0.00	0.39	0.78	10.13	1.46
23	2.92	1.17	0.00	0.00	0.00	17.73	0.00	0.00	3.90	0.00	0.68	9.98
24	0.00	0.00	0.00	0.00	0.00	0.00	3.80	0.00	0.00	0.00	1.27	0.24
25	3.65	0.00	0.00	0.39	0.00	0.00	0.00	0.00	1.36	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	8.28	0.00	0.00	0.00	0.00	0.10	0.00
27	0.00	0.00	0.00	0.00	0.00	0.10	0.00	24.25	0.00	0.00	7.11	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.65	0.10	0.78	2.43	0.00
29	0.00		1.70	0.00	4.58	0.00	0.00	0.00	1.75	0.00	0.00	36.04
30	0.24		3.65	0.00	0.00	0.00	27.56	0.00	5.94	0.00	0.00	5.36
31	0.00		0.00		0.00		0.00	0.00		0.00		0.00
0 SUM	55.76	85.27	37.50	54.15	106.80	75.78	131.49	176.29	107.24	88.73	80.55	90.58

SUM of monthly values 1.09015E+03

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                                          KETTLE CK. PRECIPITATION mm.

                              Annual data display: Summary for period ending 1991/12

  Day       JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

    1      0.00      0.00      2.38      0.11      2.54      0.00      0.00      0.00      0.00      0.00      0.42      0.00
    2      0.00      0.00     11.40      0.00      0.00      0.00      1.48      0.00      0.00      0.00      0.00      0.85
    3      0.00      0.00      0.00      0.00      0.00      0.00      0.21      3.71      7.63      0.64      0.00     11.45
    4      0.00      0.00      6.36      1.27      0.00      0.00      1.48      0.42      0.32     33.81      0.00      0.00
    5      1.06      0.00      0.00      1.80      3.29      0.00      1.17      0.00      0.00      0.11      0.00      2.33

    6      0.00      0.00     19.61      2.33      0.95      0.00      0.00      0.00      0.00      0.42      0.00      2.23
    7      0.00      0.00      0.00      0.00      0.00      0.00     21.20      0.00      0.00      0.00      0.00      0.00
    8      0.00      0.00      0.00      4.66      0.00      0.00      0.11      5.19      4.45      0.00      0.00      0.00
    9      0.00      0.00      1.59      7.53      5.30      0.00      0.00      0.00      0.00      0.00      0.32      0.85
   10      0.00      0.00      0.00      0.00      0.00      0.21      0.00      0.00      0.00      0.85      0.00      0.00

   11      4.51      0.00      0.00      0.00      0.00     15.37      0.00      0.00      0.00      0.11      0.00      0.00
   12      0.00      0.00      0.00      0.00      0.00      0.00      0.21      0.00      0.00      0.00      0.42      1.91
   13      0.00      0.00      0.00      0.00      0.00      0.00      8.16      0.00      0.00      0.00      0.00      0.00
   14      0.00      1.59      0.00      6.57      0.00      0.00      0.00     19.50      0.00      3.18      0.11      1.17
   15      0.00      0.00      0.00      8.59      0.00     11.02      0.00      7.63      2.12      0.00      6.89      0.00

   16      3.97      0.00      0.00      0.00      0.00      0.11      0.00      0.00      0.00      0.00      0.00      0.00
   17      0.00      0.00      0.00      0.00      3.60      0.00      0.00      5.19      0.00      0.00      0.00      1.17
   18      0.00      2.12     10.60      0.00      0.00      0.00      0.00      0.11      0.00      1.38      8.16      0.00
   19      0.00      0.26      0.00     11.45      0.00      0.00      0.00      0.00      0.00      3.39      4.66      0.00
   20      0.00      0.00      0.00     10.07      0.00      0.00      1.80      3.60      0.00      0.00     19.08      1.59

   21      0.00      0.00      0.79      0.85      0.00      0.00      0.21      0.00      0.00      0.00      0.11      0.53
   22      0.00      0.00      0.00      0.11      0.00      1.27      1.48      0.42      0.00      0.00      0.00      0.00
   23      0.00      0.00      2.91      0.11      0.00      0.00      0.00      0.00      5.19      0.00      1.70      0.00
   24      0.00      0.00      2.12      1.80      0.32      0.00      0.00      0.00      0.00     23.96      0.00      0.00
   25      0.00      0.00      0.00      0.00      5.09      0.00      0.00      0.00      0.42     19.93      0.00      0.00

   26      0.00      0.00      0.00      0.00     34.98      0.00      0.00      0.00      0.11      3.18      0.00      0.00
   27      0.00      0.00     10.33      0.00      0.00      0.00      0.00      0.00      0.00     10.49      0.42      0.00
   28      0.00      0.00      0.00      0.11      2.44      0.00      0.00      0.00      0.00      0.00     10.71      0.00
   29      0.00                0.00      0.21      0.00      0.00      1.91      0.00      0.00      0.00     13.99      1.80
   30      0.00                0.00      0.00      2.12      0.53      6.57      6.78      0.00      0.00      0.74      0.00
   31      0.00                0.00                0.95                0.00      0.11                0.11                0.00
0 SUM      9.54      3.97     68.10     57.56     61.59     28.51     46.00     52.68     20.25    101.55     67.73     25.86

  SUM  of monthly values  5.43356E+02


                                          KETTLE CK. PRECIPITATION mm.

                              Annual data display: Summary for period ending 1992/ 6

  Day       JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

    1      0.00      0.00      0.00      0.20      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
    2      0.00      0.00      0.00      0.00      4.30      0.00      0.00      0.00      0.00      0.00      0.00      0.00
    3      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
    4      0.30      0.00      0.00      0.00      0.10      3.20      0.00      0.00      0.00      0.00      0.00      0.00
    5      0.00      0.00      0.00      0.00      2.20      2.60      0.00      0.00      0.00      0.00      0.00      0.00

    6      0.00      0.00     11.20      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
    7      0.00      0.00      4.10      1.80      0.00     12.80      0.00      0.00      0.00      0.00      0.00      0.00
    8      0.00      0.00      3.10      0.00      0.00      0.10      0.00      0.00      0.00      0.00      0.00      0.00
    9      1.80      0.00      0.10      0.10      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
   10      0.00      0.00      7.40      0.20      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

   11      0.00      0.00      0.00      8.30      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
   12      1.70      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
   13      0.10      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
   14      9.30      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
   15      0.00     27.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

   16      0.00      0.40      0.00     44.90      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
   17      0.00      0.20      0.60      0.00      1.30     13.90      0.00      0.00      0.00      0.00      0.00      0.00
   18      0.00      7.70      0.00      3.80      0.00     20.70      0.00      0.00      0.00      0.00      0.00      0.00
   19      0.00      8.90      0.00      0.00      0.00      0.10      0.00      0.00      0.00      0.00      0.00      0.00
   20      0.00      0.00      0.00      0.40      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

   21      0.00      0.10      0.00      6.80      0.10      0.00      0.00      0.00      0.00      0.00      0.00      0.00
   22      0.00      0.80      0.30      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
   23     13.70      1.00      0.10     11.50      4.90      2.20      0.00      0.00      0.00      0.00      0.00      0.00
   24      0.10      0.00      0.00      8.60      0.20      0.10      0.00      0.00      0.00      0.00      0.00      0.00
   25      0.00      1.90      3.50      1.40      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

   26      0.00      0.00      1.00      1.80      0.00      4.50      0.00      0.00      0.00      0.00      0.00      0.00
   27      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
   28      0.00      4.50      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
   29      0.00      0.00      0.00      1.60      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
   30      0.00                1.20      0.70      7.40      0.00      0.00      0.00      0.00      0.00      0.00      0.00
   31      0.00                3.60                9.40                0.00      0.00                0.00                0.00
0 SUM     27.00     52.50     36.20     92.10     29.90     60.20      0.00      0.00      0.00      0.00      0.00      0.00

  SUM  of monthly values  2.97900E+02
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PITTOCK PRECIPITATION (mm)

Annual data display: Summary for period ending 1989/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.00	0.00	0.00	0.00	0.00	1.15	0.00	0.00	5.98	0.00	0.00	0.00
2	0.00	0.00	0.00	2.20	0.42	8.50	0.00	0.00	0.00	1.78	3.04	0.00
3	0.00	0.00	0.00	9.23	0.00	2.73	0.00	0.00	0.00	0.42	0.31	0.00
4	0.80	0.00	1.90	6.19	0.00	0.10	0.00	8.29	0.00	0.00	0.10	0.00
5	0.00	0.00	0.00	3.57	8.92	0.00	0.00	0.00	0.00	2.31	2.52	0.35
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.99	1.47	4.30	0.27
7	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.10	4.62	2.20	18.25	0.29
8	5.13	0.00	0.00	0.00	0.00	2.41	0.00	0.00	0.10	0.10	1.15	0.00
9	0.00	0.00	0.00	0.00	0.00	21.92	0.00	0.84	0.21	0.00	3.15	0.00
10	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.10	0.00	33.36	0.00	0.00
11	0.00	0.00	0.00	0.00	3.25	0.00	0.00	0.00	0.00	0.21	0.73	0.21
12	2.45	0.00	0.00	2.94	8.39	0.63	1.36	0.00	0.00	0.00	0.00	0.00
13	0.00	0.83	0.00	3.88	0.00	0.00	0.10	0.00	0.31	0.00	0.00	0.00
14	4.13	1.12	0.00	6.82	0.00	0.00	0.00	0.00	3.46	0.00	7.76	0.00
15	0.00	0.00	0.00	1.36	0.00	0.00	0.00	27.06	0.10	0.00	41.96	0.00
16	0.00	0.00	0.00	0.00	0.00	1.57	0.00	0.10	7.13	1.26	3.15	0.00
17	0.00	0.00	0.00	5.98	0.00	13.32	0.00	0.00	0.63	5.77	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	5.35	28.53	0.00	0.00	2.20	0.00	0.00
20	0.53	0.00	0.00	0.00	5.35	1.05	4.62	0.10	0.00	4.62	2.41	0.00
21	0.00	5.75	0.00	0.00	0.00	3.04	0.00	0.10	0.00	5.14	0.00	0.00
22	0.00	0.27	0.00	0.00	0.00	17.73	0.00	1.36	2.73	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	5.66	0.00	0.00	0.00	1.36	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	5.87	0.00	1.89	0.00	0.00	0.10	0.00	0.00
26	8.88	2.45	0.00	4.93	16.26	0.84	0.00	0.00	0.00	0.00	0.84	0.00
27	0.00	3.54	0.31	0.00	0.00	0.00	15.00	0.00	0.00	0.00	10.07	0.53
28	0.00	0.00	3.78	0.00	0.00	0.00	0.00	0.94	0.00	0.00	0.10	0.83
29	1.65		0.00	4.62	0.00	0.00	0.00	2.41	0.00	0.00	0.00	0.80
30	0.24		0.00	0.00	25.39	0.00	0.21	0.00	0.00	0.00	0.00	1.68
31	0.00		0.00		5.04		0.00	0.84		0.73		7.67
0 SUM	25.70	13.96	6.00	51.72	84.65	80.35	51.72	42.27	28.64	62.21	99.86	12.62

SUM of monthly values 5.59697E+02

PITTOCK PRECIPITATION (mm)

Annual data display: Summary for period ending 1990/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.00	3.59	0.00	1.40	0.00	0.00	0.00	0.00	0.21	1.18	0.00	0.00
2	1.07	3.65	0.00	3.76	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00
3	0.00	0.00	0.00	0.54	0.00	20.84	0.00	0.00	0.00	0.00	0.00	0.27
4	0.27	0.90	0.00	0.11	9.24	0.21	0.00	3.33	1.72	19.12	2.68	0.00
5	0.00	0.00	0.00	0.00	4.94	0.00	0.32	3.11	5.16	0.00	49.08	0.00
6	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	7.20	0.00	0.97	0.00
7	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	4.94	7.09	0.64	0.00
8	0.00	0.00	0.00	0.00	0.00	4.19	63.26	0.00	0.00	1.07	0.32	0.00
9	0.27	3.33	7.19	0.00	0.00	0.11	1.72	0.00	0.97	25.35	3.44	0.57
10	0.00	0.00	0.85	17.61	4.08	0.00	0.00	0.00	0.00	8.05	0.43	0.00
11	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	5.26	0.00	0.00
12	0.00	0.00	0.90	0.00	5.48	0.00	0.00	17.72	0.00	10.20	0.00	0.27
13	0.00	1.42	0.00	0.00	18.15	0.00	0.00	16.32	0.00	0.11	0.00	0.57
14	0.00	0.00	0.00	5.91	0.00	0.64	17.40	0.00	34.80	0.11	0.00	1.07
15	0.00	1.07	0.00	1.40	0.75	0.00	0.54	0.11	0.54	0.11	0.00	0.82
16	0.30	0.00	0.33	1.50	19.44	0.00	0.32	0.00	2.58	0.00	1.18	0.30
17	8.37	0.00	0.55	1.83	18.80	0.00	4.94	0.00	0.00	10.42	0.00	3.65
18	2.29	0.00	0.57	0.00	2.04	1.83	4.51	1.61	0.00	18.47	0.00	5.04
19	0.00	0.00	3.68	0.00	4.83	0.00	4.08	36.52	4.08	0.11	0.00	0.00
20	0.00	0.00	0.03	9.56	7.09	0.43	8.27	0.43	0.43	0.00	0.00	0.00
21	0.00	1.07	0.27	0.00	0.00	0.32	0.00	0.11	2.36	1.50	0.54	5.80
22	1.09	38.40	6.98	0.00	0.00	11.06	10.74	0.00	1.61	0.00	13.75	2.86
23	0.35	1.69	0.00	0.00	0.00	17.18	0.00	0.00	2.58	0.00	3.01	11.83
24	0.90	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.27
25	4.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.33	0.00	0.00	0.00
26	0.55	0.00	0.03	0.00	0.00	3.87	0.00	0.00	0.00	0.00	0.54	0.00
27	0.00	0.00	0.03	0.00	0.00	0.00	0.00	16.00	0.00	0.86	7.20	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.63	15.04	0.86	4.62	0.00
29	0.00		0.11	0.00	0.00	2.90	0.00	0.00	0.75	0.00	0.00	36.11
30	0.00		4.56	0.00	0.00	0.00	33.62	0.00	9.77	0.00	0.00	4.93
31	0.00		0.00		0.00		0.00	0.00		0.00		0.00
SUM	19.77	55.13	31.09	43.60	94.94	63.69	149.72	105.90	98.06	110.09	88.61	74.39

SUM of monthly values 9.34976E+02

PITTOCK PRECIPITATION (mm)

Annual data display: Summary for period ending 1991/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.00	0.00	1.63	1.37	3.38	0.00	0.00	0.00	0.00	0.11	0.53	0.00
2	0.00	0.00	10.73	0.00	1.16	0.00	2.74	8.55	0.00	0.32	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	5.06	7.17	6.22	1.27	0.00	0.00
4	0.00	0.27	0.00	1.06	0.00	0.00	15.61	12.13	0.74	13.93	0.00	0.00
5	1.05	0.00	3.74	0.42	3.90	0.00	1.27	0.00	0.00	1.37	0.00	0.00
6	0.00	0.00	11.82	1.69	4.22	0.00	0.11	0.00	0.00	3.16	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	30.17	0.00	0.00	2.74	0.00	7.49
8	0.00	0.00	0.00	14.24	0.00	0.00	0.11	0.53	0.00	0.00	0.00	0.42
9	0.00	0.00	2.49	14.98	6.01	0.00	0.00	0.00	0.00	0.00	0.00	0.84
10	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	11.06	0.00	0.00	0.00	0.53	0.00	0.00
12	0.56	0.00	0.00	0.00	0.00	0.83	1.16	0.00	0.00	0.00	0.53	1.79
13	0.00	0.00	0.00	0.00	0.00	0.00	14.56	0.00	0.00	0.00	0.00	0.74
14	0.56	4.96	0.00	7.17	0.00	0.00	0.00	0.00	0.00	4.64	0.11	0.74
15	0.00	0.00	0.00	12.03	0.00	9.40	0.00	1.90	18.36	0.00	9.81	0.00
16	3.00	0.00	0.00	0.00	6.22	0.00	0.00	0.11	0.32	0.00	0.00	1.69
17	0.00	0.00	0.00	0.00	9.39	0.00	0.00	17.09	0.00	0.00	0.00	0.00
18	0.00	1.10	11.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.80	0.00
19	0.00	2.22	0.00	1.58	0.00	0.00	0.00	0.00	0.00	2.32	1.58	0.00
20	0.32	0.00	0.00	16.88	0.00	0.00	0.00	0.53	0.11	0.00	19.31	0.74
21	0.00	0.00	0.00	1.90	0.00	0.00	0.53	0.21	0.00	0.00	0.11	0.11
22	0.00	0.00	0.29	1.48	0.00	1.16	0.11	0.00	0.00	0.21	0.00	0.00
23	0.00	0.00	5.18	0.00	0.00	0.00	0.00	0.00	9.92	0.00	1.90	0.00
24	0.00	1.66	3.35	2.43	3.97	0.00	0.00	0.00	0.00	6.44	0.00	0.00
25	0.00	0.29	0.29	0.00	2.48	0.00	0.00	0.00	0.42	16.99	0.00	0.00
26	0.00	0.00	0.00	0.00	11.54	0.00	0.00	0.00	1.16	2.95	0.00	0.00
27	0.27	0.00	20.88	0.00	0.00	0.00	0.00	0.00	0.32	9.18	0.84	0.00
28	0.00	0.00	1.37	0.95	3.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00		0.83	0.00	0.29	0.00	10.02	0.00	0.00	0.00	18.88	2.53
30	1.10		0.00	0.00	1.05	0.00	26.48	0.00	0.11	0.00	6.75	0.00
31	0.00		0.00		0.00		0.00	0.21		0.00		0.00
0 SUM	6.87	10.50	74.40	78.18	57.36	22.45	107.93	48.42	37.66	66.68	66.15	17.09

SUM of monthly values 5.93689E+02

PITTOCK PRECIPITATION (mm)

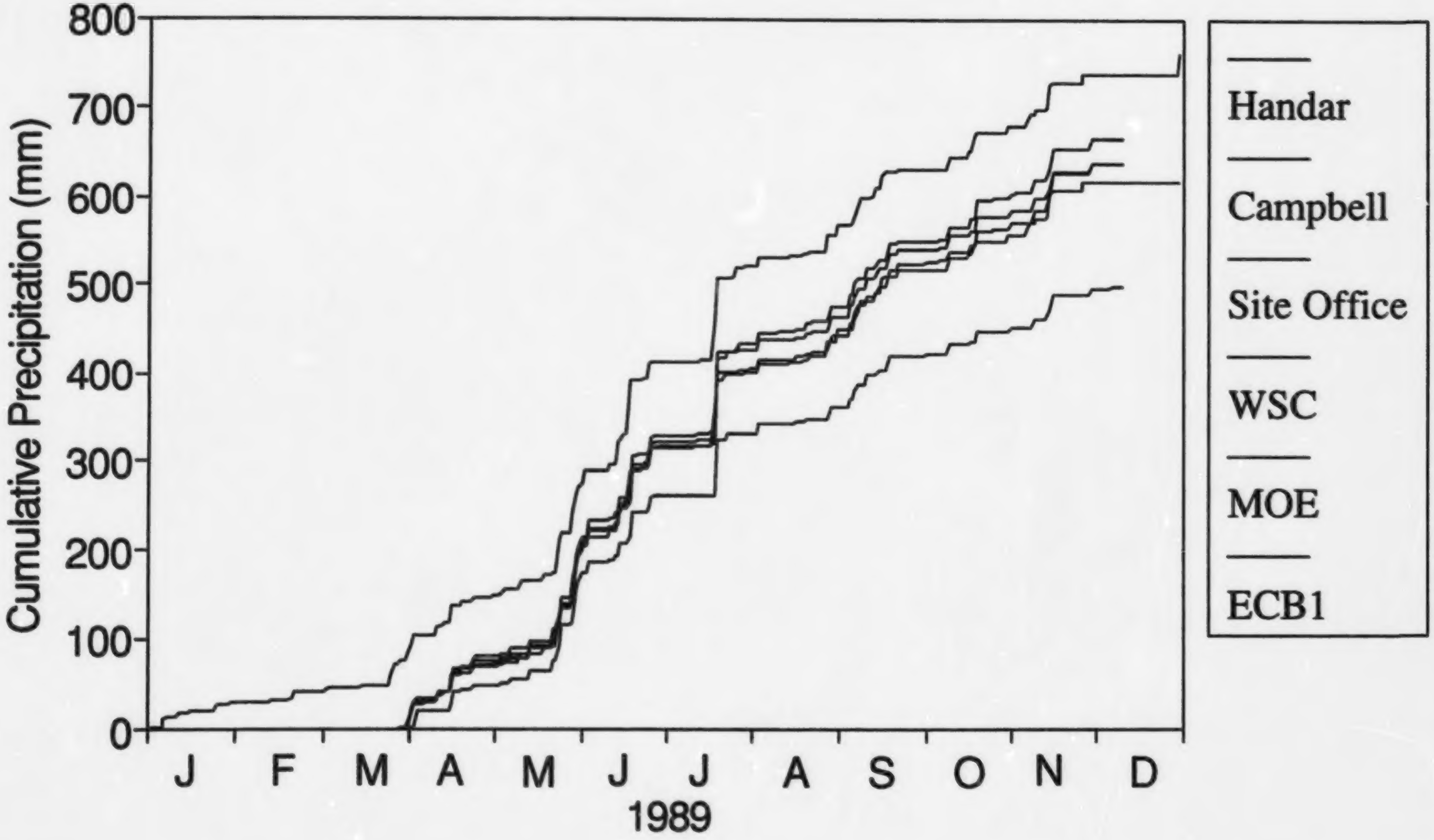
Annual data display: Summary for period ending 1992/ 6

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	18.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	1.90	0.00	0.00	0.00	0.00	2.85	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	4.33	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	8.44	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.11	1.16	1.90	0.00	3.69	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	1.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	5.38	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	19.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	3.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	19.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.21	0.00	51.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.21	23.21	7.70	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	2.64	0.00	0.95	0.00	14.35	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	6.54	0.00	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.63	0.00	0..	..00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	4.43	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	8.12	0.00	1.16	1.69	2.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	4.85	0.00	7.81	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	1.05	2.11	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.11	0.32	0.00	4.33	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	3.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00		0.42	0.84	5.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00		1.27		12.77		0.00	0.00		0.00		0.00
0 SUM	15.19	30.70	20.15	94.63	62.56	45.79	0.00	0.00	0.00	0.00	0.00	0.00

SUM of monthly values 2.69025E+02

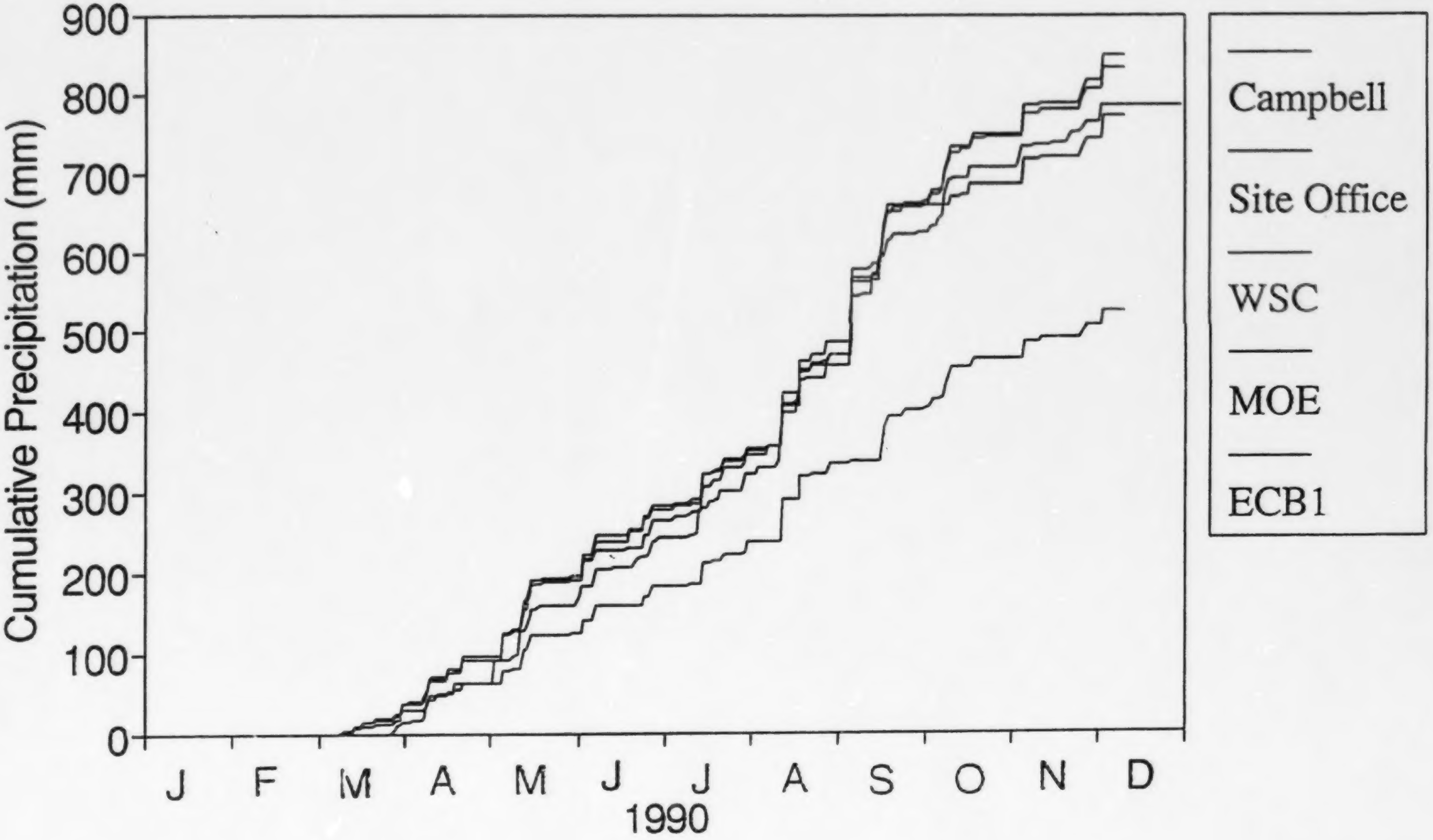
Essex Watershed

Cumulative Precipitation 1989



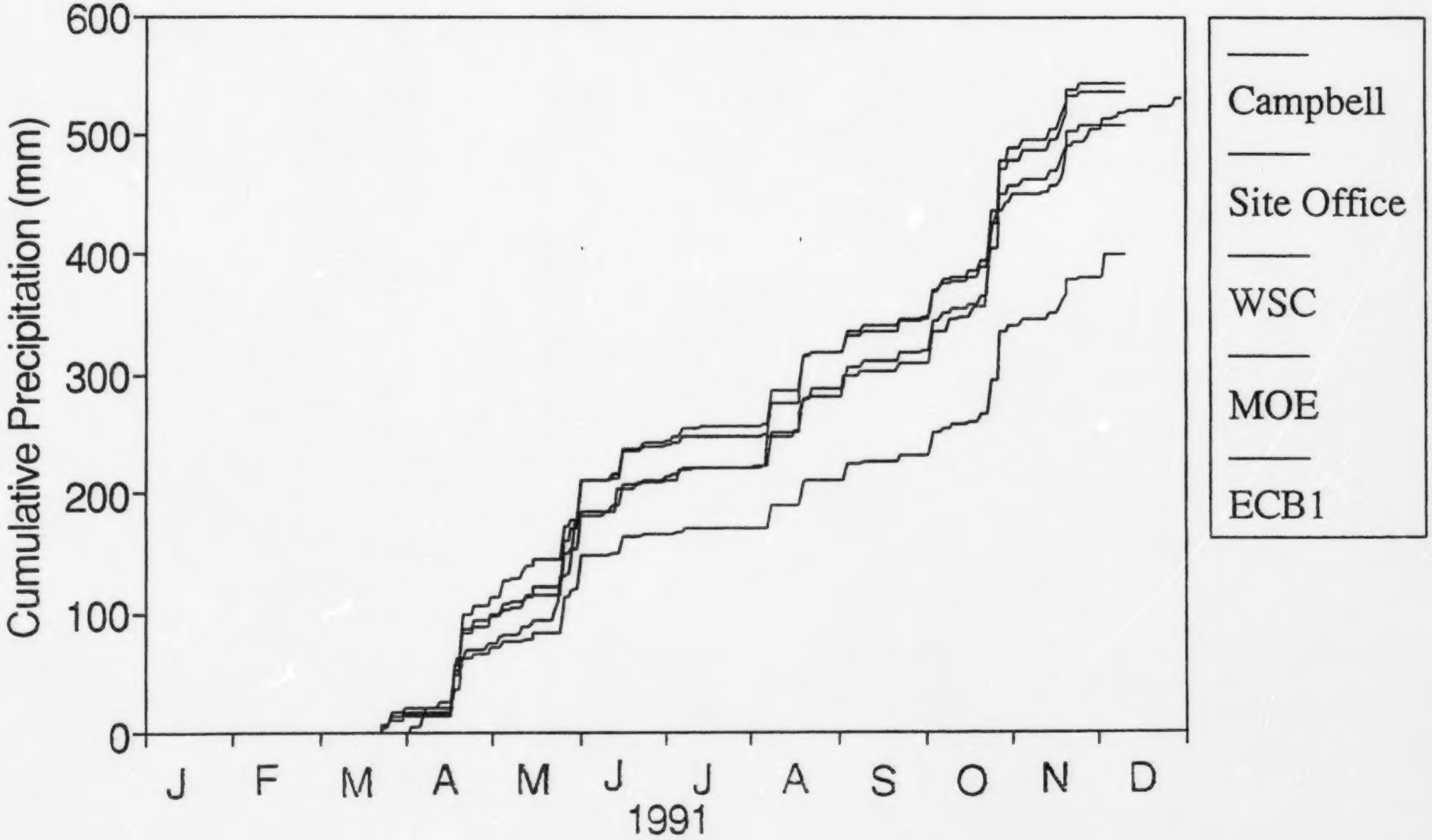
Essex Watershed

Cumulative Precipitation 1990



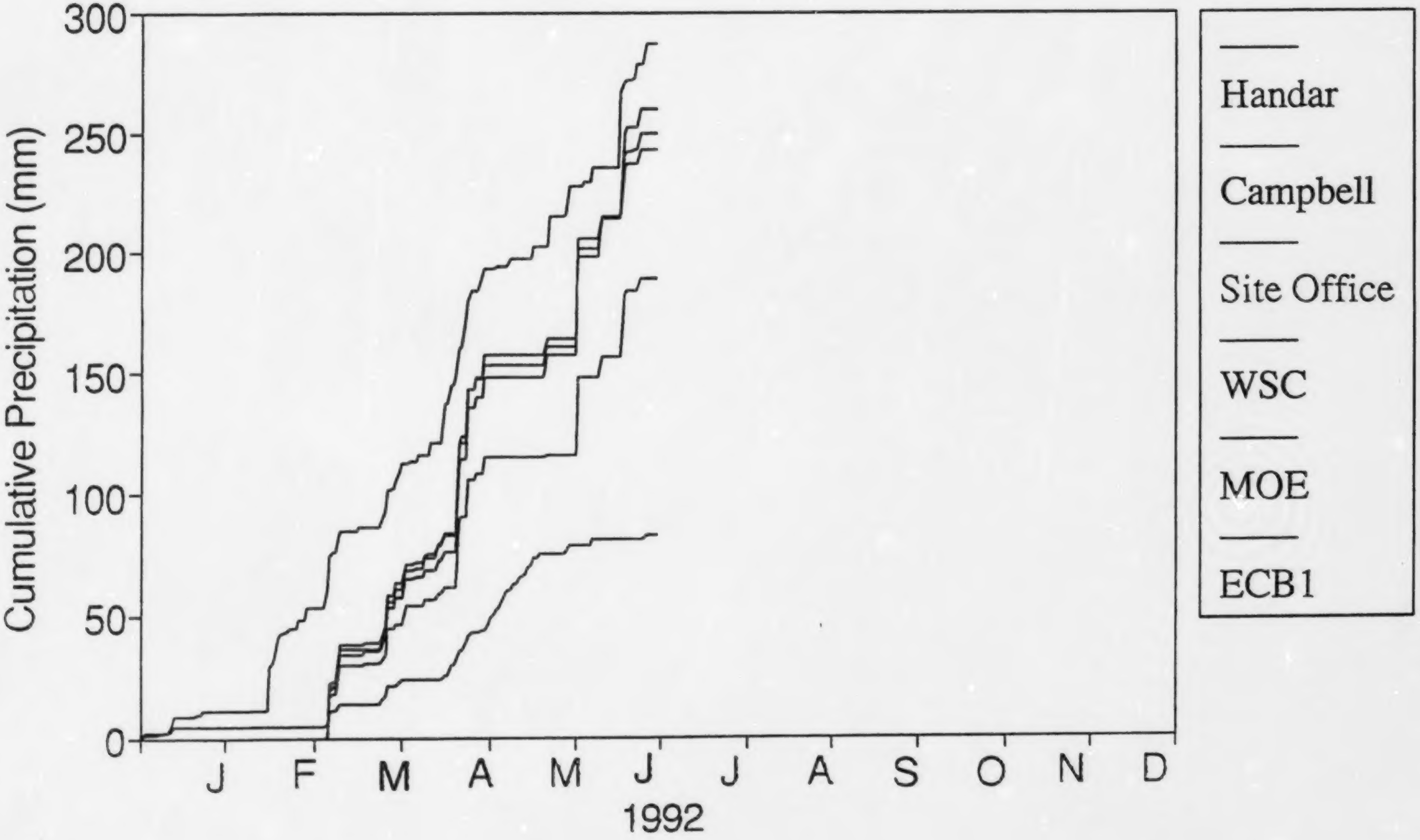
Essex Watershed

Cumulative Precipitation 1991



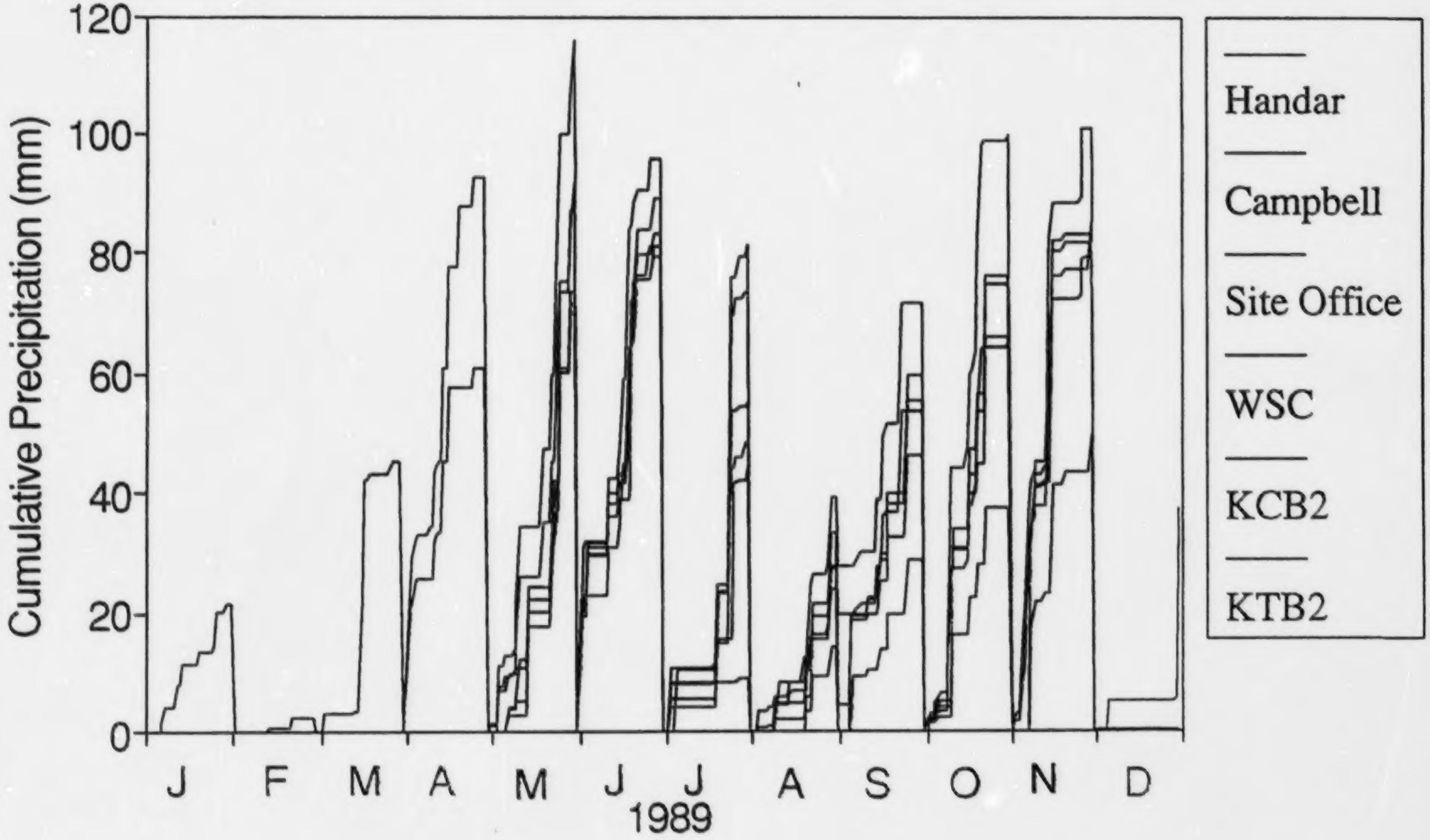
Essex Watershed

Cumulative Precipitation 1992



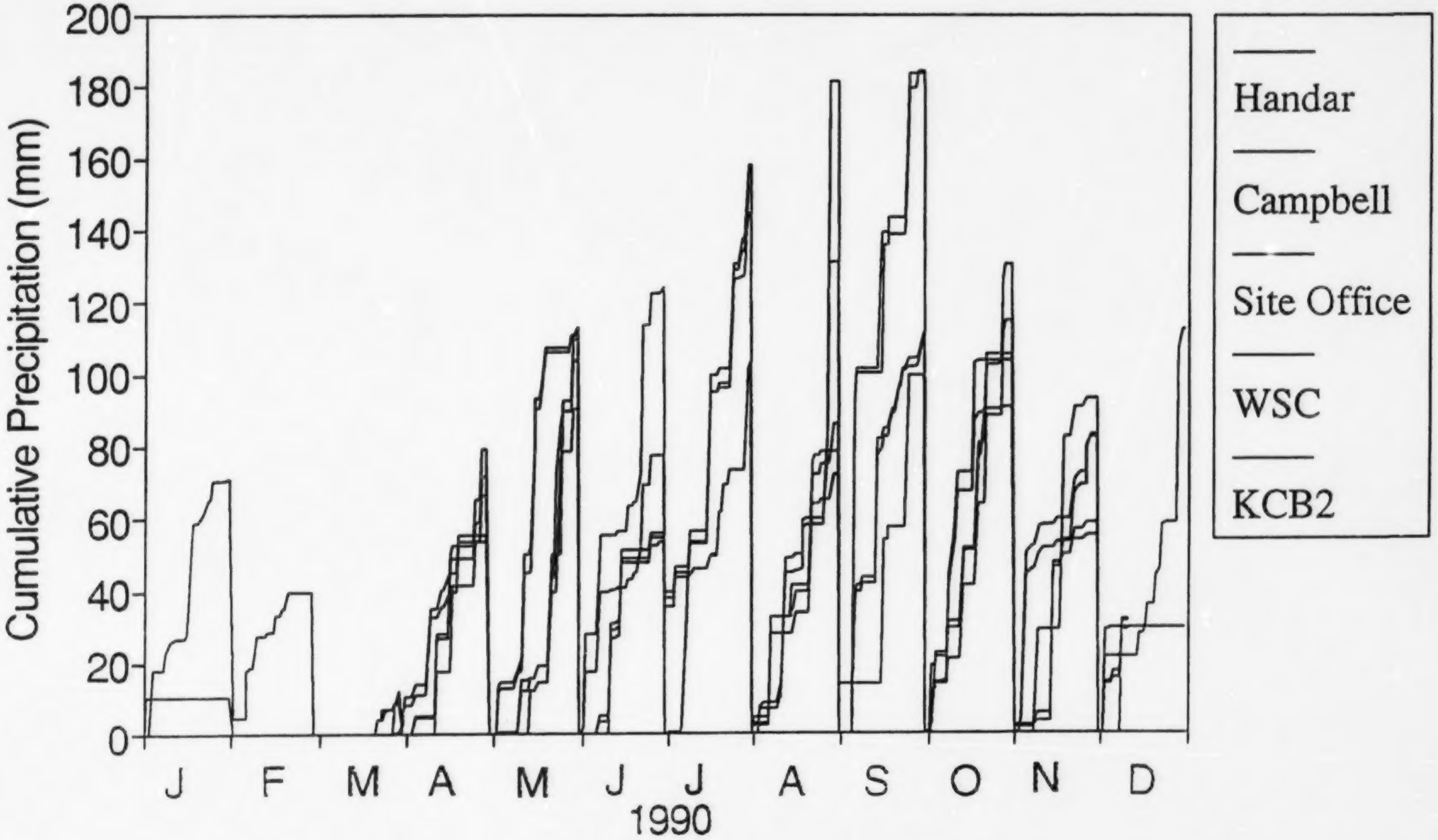
Kettle Creek Watershed

Cumulative Precipitation 1989



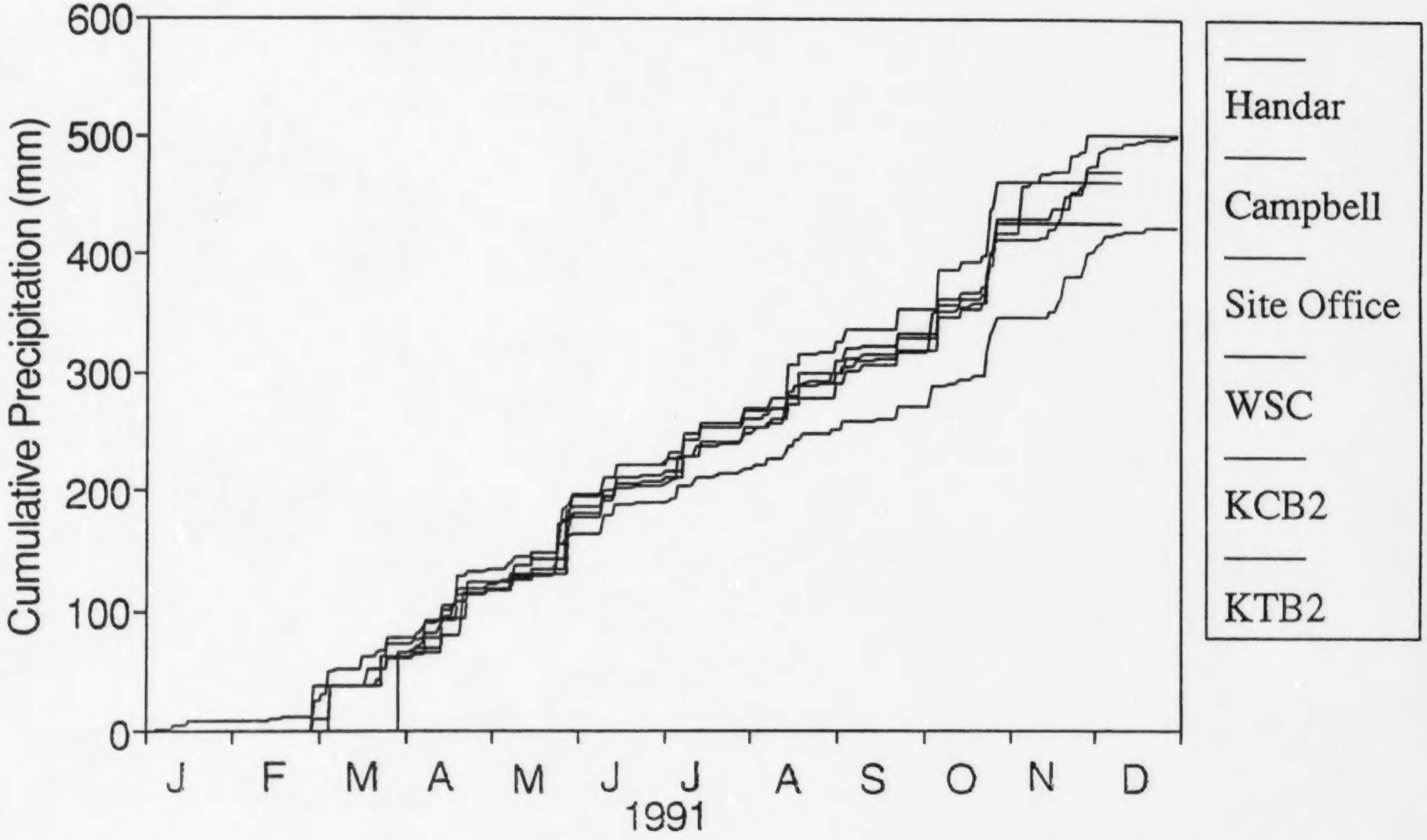
Kettle Creek Watershed

Cumulative Precipitation 1990



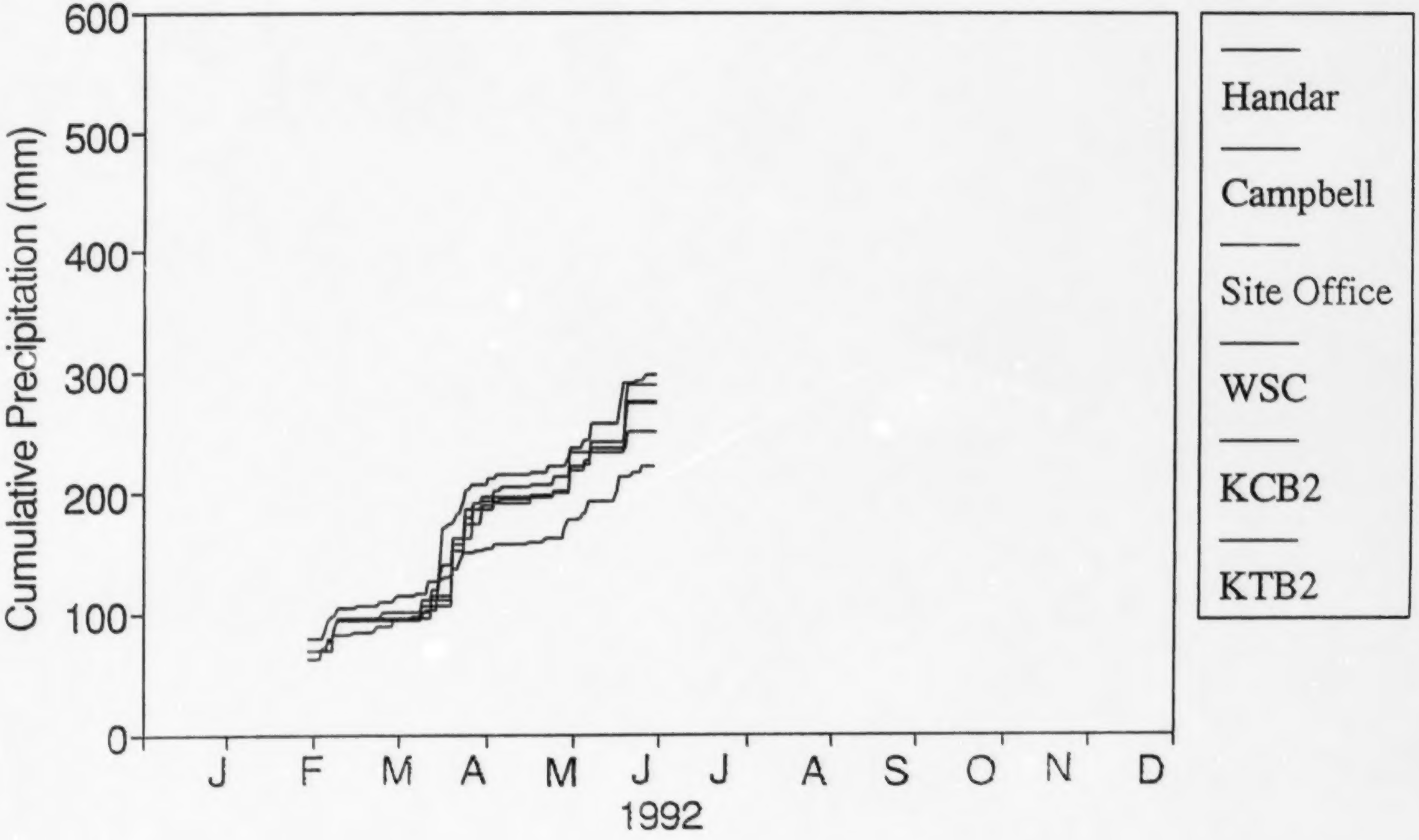
Kettle Creek Watershed

Cumulative Precipitation 1991



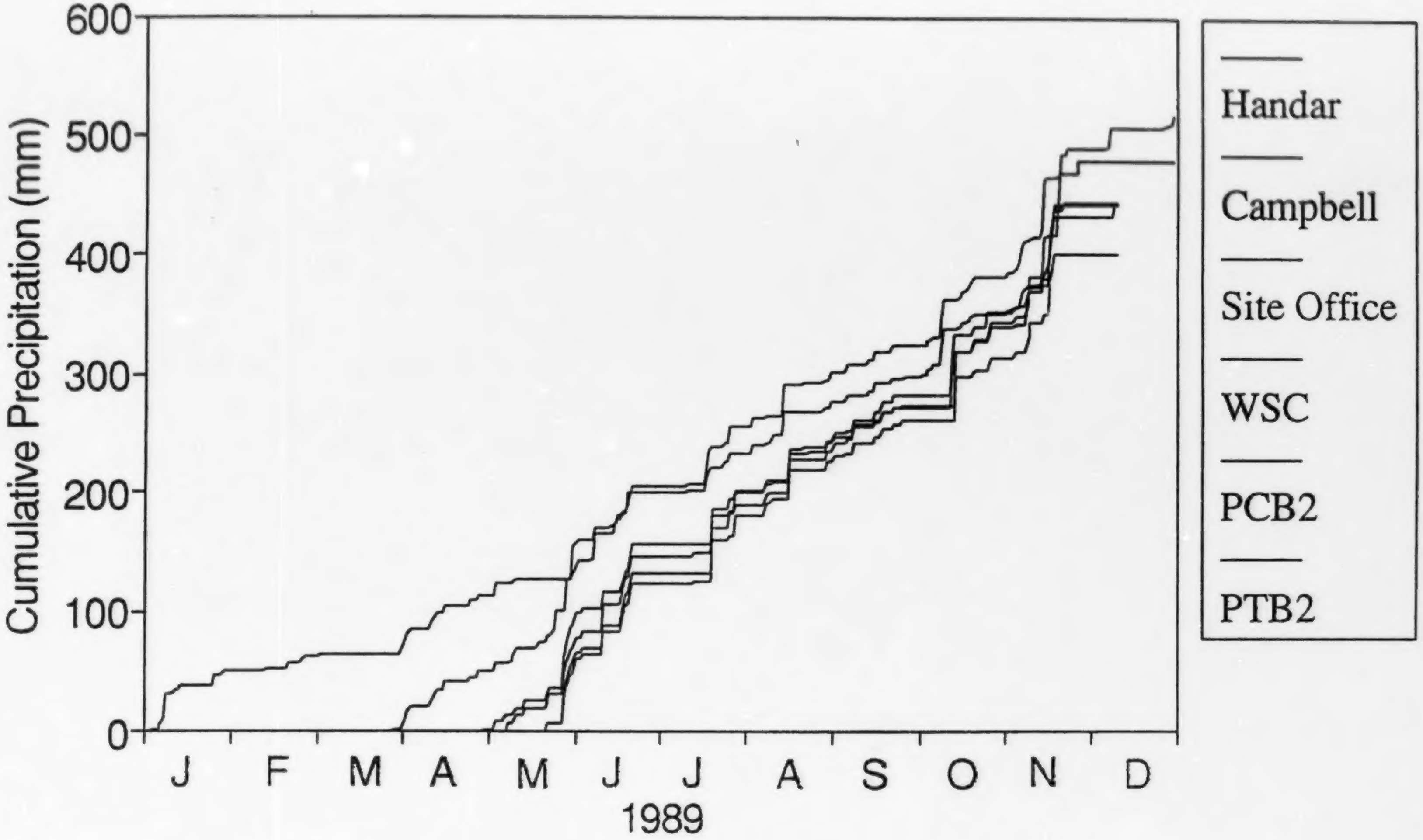
Kettle Creek Watershed

Cumulative Precipitation 1992



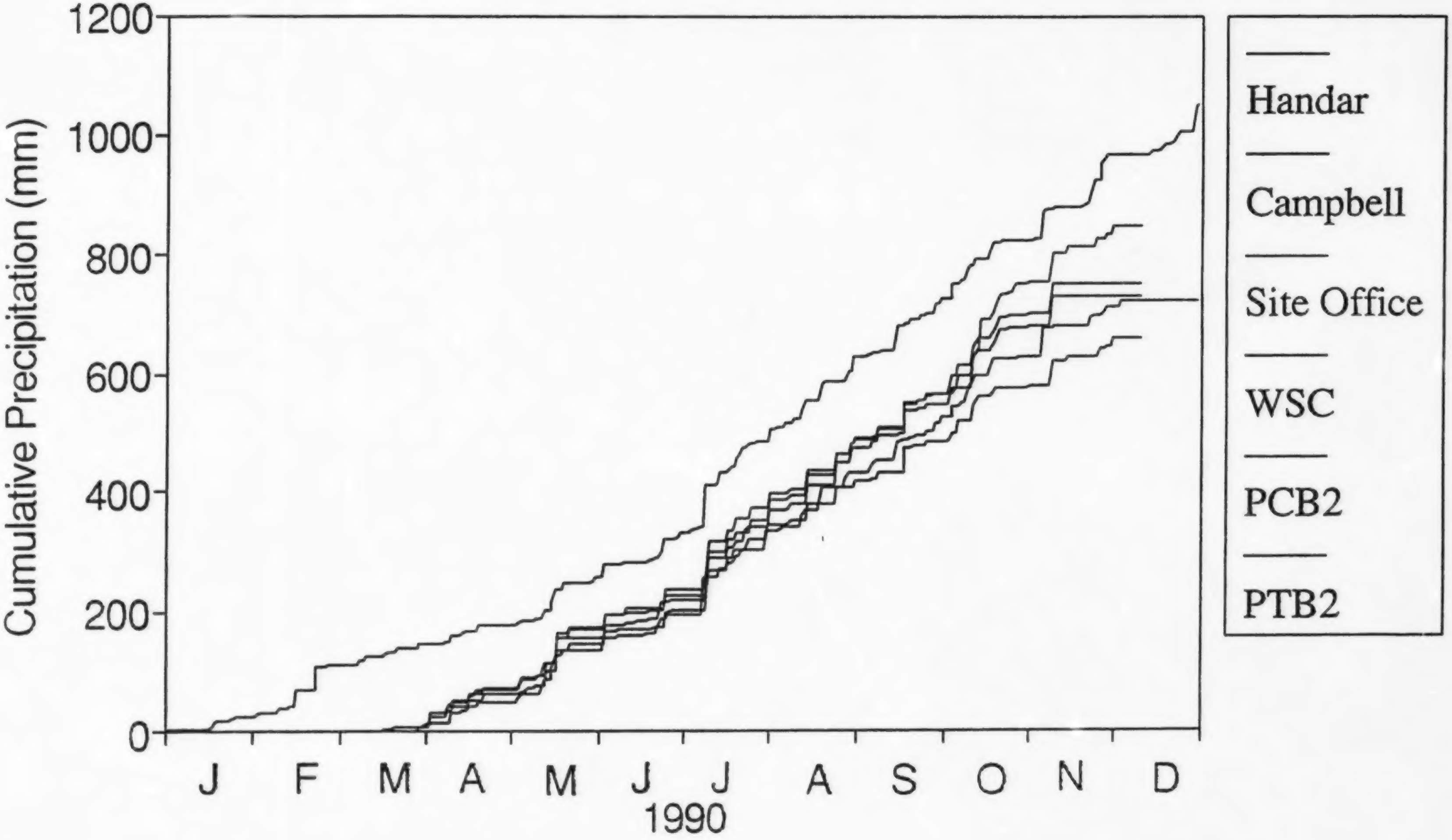
Pittock Watershed

Cumulative Precipitation 1989



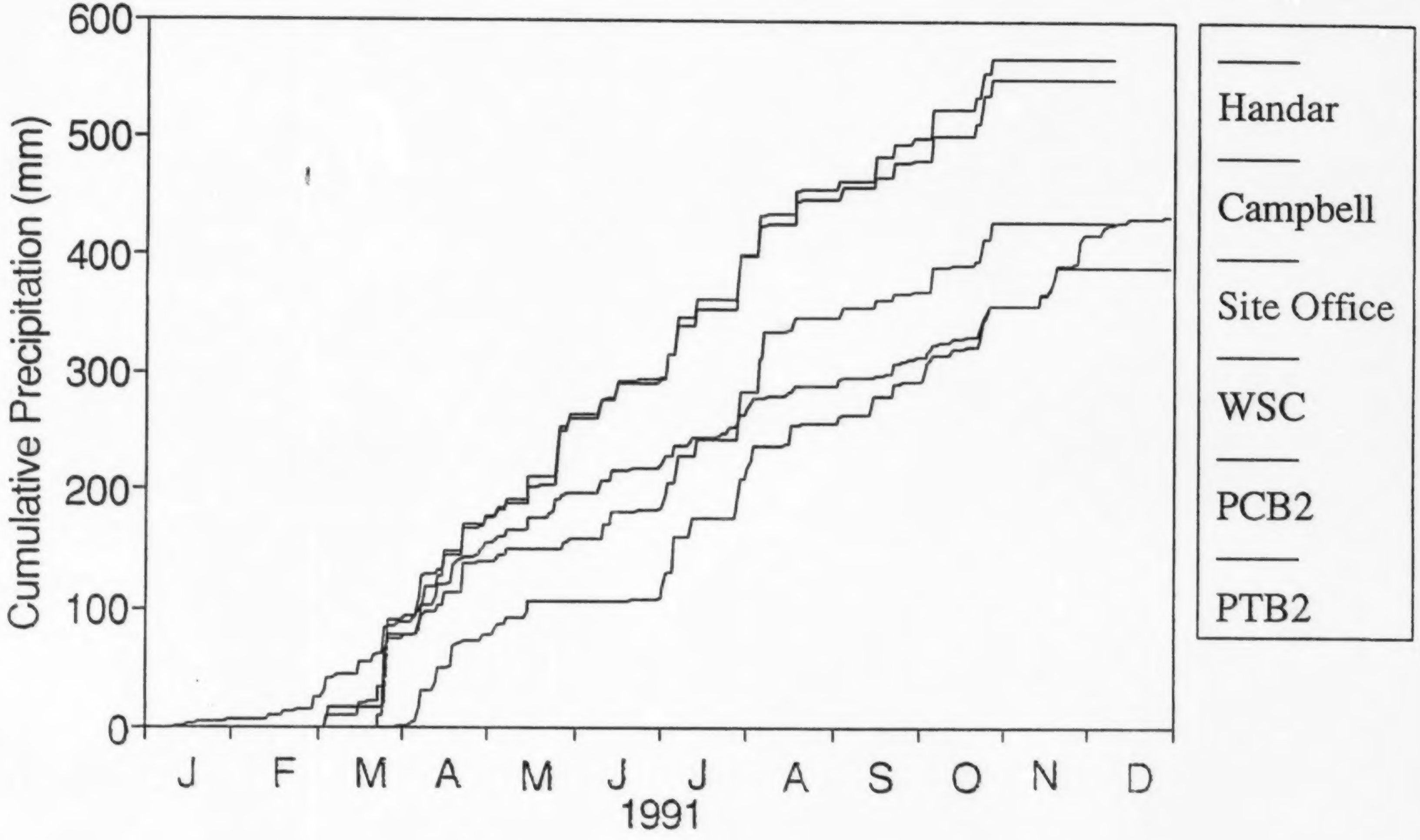
Pittock Watershed

Cumulative Precipitation 1990



Pittock Watershed

Cumulative Precipitation 1991



ESSEX - AVG. DAILY WIND SPEED (M/S)

Annual data display: Summary for period ending 1989/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	3.2	6.9	7.2	3.9	5.4	2.4	1.7	1.8	3.8	4.0	4.6	2.8
2	6.7	6.2	2.0	5.4	4.2	4.0	2.7	4.3	3.3	5.0	4.0	7.4
3	3.3	6.1	8.0	3.9	3.8	3.4	1.7	4.0	2.0	4.9	3.4	7.8
4	4.0	2.7	3.8	5.5	4.3	3.2	1.9	4.2	4.1	4.2	4.5	3.2
5	3.6	1.8	8.2	5.3	6.0	2.6	2.5	3.9	2.1	3.4	5.9	2.2
6	4.8	7.1	11.0	2.5	3.0	2.8	1.6	5.1	1.2	5.5	4.3	4.0
7	5.5	6.7	8.2	1.8	5.5	2.1	3.3	4.2	1.4	3.9	3.5	3.1
8	11.9	9.4	3.6	4.1	3.2	2.5	2.0	2.5	2.6	2.8	3.4	2.4
9	6.2	7.9	1.4	5.8	3.3	3.3	2.6	2.1	2.9	2.4	6.4	3.0
10	5.4	7.2	2.7	5.3	6.7	4.8	6.1	1.6	3.9	5.3	4.7	3.5
11	5.8	7.0	4.0	3.3	8.3	2.1	3.7	1.1	1.5	3.5	6.7	3.8
12	6.1	4.5	6.9	5.3	4.7	4.2	2.0	1.2	1.3	3.4	2.9	3.4
13	4.8	5.8	2.4	3.3	4.7	1.5	4.1	1.5	4.3	1.9	5.5	1.7
14	3.7	3.0	5.0	5.7	2.1	2.1	3.5	2.3	5.0	2.7	4.4	4.8
15	5.5	2.9	8.0	2.4	2.5	2.5	2.0	2.7	3.0	2.6	5.5	4.3
16	5.9	4.5	4.9	4.6	4.0	3.4	1.8	1.9	4.3	5.2	9.2	4.8
17	6.1	3.3	5.3	5.4	2.1	4.7	1.7	2.5	3.4	7.1	8.4	4.0
18	5.7	2.5	1.2	2.8	2.6	3.2	2.8	3.2	1.4	8.0	7.1	3.9
19	5.5	3.4	2.5	3.7	3.7	2.3	3.0	1.6	1.9	7.8	5.8	2.3
20	7.8	2.7	3.3	4.4	4.9	2.0	5.9	3.2	1.1	4.3	9.9	4.8
21	4.4	3.9	4.7	3.5	4.4	3.3	3.5	3.3	1.6	5.8	6.9	5.0
22	5.1	6.3	2.3	4.1	2.0	1.3	1.6	3.8	3.6	3.2	2.4	4.0
23	3.9	7.2	4.5	2.7	3.3	2.0	1.0	4.3	7.7	2.4	5.2	2.8
24	3.6	2.8	3.8	2.3	3.5	2.1	1.1	4.6	2.1	2.7	5.0	4.5
25	6.8	3.8	4.5	3.1	4.5	2.2	1.5	3.3	1.8	1.9	5.6	7.0
26	5.9	5.6	4.5	3.5	5.1	2.5	2.7	2.2	5.6	1.3	2.8	6.1
27	5.6	3.8	5.7	3.8	4.8	2.5	3.3	1.3	1.7	1.6	6.7	4.6
28	5.1	4.7	6.3	5.4	1.6	4.7	5.0	2.0	2.1	2.0	7.6	3.3
29	4.0		5.4	3.6	2.8	3.8	2.1	3.0	3.8	2.3	6.2	5.0
30	5.9		4.0	3.0	3.3	1.6	3.1	3.1	3.2	2.7	5.1	5.2
31	6.6		5.4		2.8		2.6	2.2		5.6		4.8
0 AVER	5.4	5.0	4.9	4.0	4.0	2.8	2.7	2.8	2.9	3.9	5.5	4.2

AVER of monthly values 4.00345E+00

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ESSEX - AVG. DAILY WIND SPEED (M/S)

Annual data display: Summary for period ending 1990/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	2.2	1.7	4.4	2.2	4.2	1.9	4.2	1.4	2.9	3.9	3.2	5.5
2	2.6	1.5	6.9	6.0	2.5	2.8	1.7	1.0	2.9	2.7	5.5	4.2
3	1.9	0.7	4.3	7.3	4.6	3.9	4.4	1.7	2.8	5.6	4.2	9.1
4	2.1	0.8	2.8	5.9	6.3	2.1	6.2	2.7	2.5	6.3	5.5	8.3
5	1.1	2.1	6.5	4.6	5.1	1.8	3.7	3.4	2.8	6.3	8.2	6.8
6	1.0	1.2	6.1	3.0	2.8	2.1	4.7	3.6	3.2	6.8	4.6	2.8
7	1.7	1.0	5.3	4.1	6.1	1.2	2.7	1.6	4.2	4.5	2.7	4.6
8	1.4	2.5	4.7	4.3	6.5	1.7	4.9	1.8	3.1	4.7	1.8	3.5
9	1.6	1.9	3.2	5.6	6.3	2.1	2.4	1.3	1.7	5.9	2.7	4.5
10	2.2	2.3	3.1	5.9	11.3	2.3	2.7	1.2	3.2	6.0	4.2	3.9
11	3.2	0.6	3.1	4.6	4.5	1.5	2.7	1.3	1.7	2.4	6.5	2.8
12	3.0	1.4	5.2	3.1	3.9	1.7	6.2	1.7	0.9	2.4	4.6	5.7
13	1.6	2.5	3.8	4.0	5.1	2.4	5.9	2.1	2.0	1.6	1.9	6.4
14	1.3	2.6	4.3	6.4	2.5	1.6	2.7	1.5	4.4	4.0	4.0	1.5
15	1.4	2.3	5.3	5.0	2.3	1.7	3.0	3.5	2.6	5.1	5.0	3.7
16	0.9	2.3	3.9	4.6	4.7	1.1	4.5	3.1	4.5	2.9	6.5	3.3
17	1.9	1.7	8.8	6.5	8.2	1.9	4.4	2.8	2.4	7.1	3.6	3.7
18	2.3	1.9	6.6	4.3	6.4	2.8	4.0	2.4	1.5	10.5	1.9	4.6
19	1.2	2.3	4.5	4.7	3.5	[illegible]	3.4	3.6	2.2	2.9	0.5	2.0
20	1.4	1.1	3.1	3.9	5.2	1.1	1.9	2.9	1.7	3.0	1.3	4.8
21	1.6	1.3	4.0	4.4	4.7	2.1	2.2	4.0	2.5	4.7	5.0	2.2
22	2.3	1.3	6.4	2.8	3.7	1.7	3.6	3.2	4.7	2.5	3.7	4.3
23	1.5	1.7	5.4	2.9	1.7	2.8	2.3	2.5	4.2	1.9	6.3	4.7
24	2.6	2.9	2.9	3.9	2.4	1.8	1.2	1.5	5.6	2.5	5.1	8.0
25	3.5	1.9	5.9	4.0	3.1	1.0	1.2	1.7	6.2	5.3	3.7	8.3
26	2.2	1.7	4.7	4.4	3.7	[illegible]	1.3	2.7	2.1	2.3	5.1	3.0
27	3.2	2.0	2.6	3.9	2.2	0.9	2.1	2.8	1.9	6.3	7.6	3.6
28	1.7	1.1	2.5	4.8	4.2	2.5	1.3	5.5	2.0	5.7	9.1	3.2
29	1.5		7.2	3.8	6.2	3.8	2.8	2.0	3.8	2.1	4.8	4.7
30	1.7		3.9	3.6	3.7	2.9	3.9	2.7	3.0	3.8	6.3	4.7
31	0.9		3.3		2.1		3.5	2.6		2.2		4.4
0 AVER	1.9	1.7	4.7	4.5	4.5	2.0	3.3	2.5	3.0	4.3	4.5	4.6

AVER of monthly values 3.45274E+00

ESSEX - AVG. DAILY WIND SPEED (M/S)

Annual data display: Summary for period ending 1991/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	4.6	2.2	5.2	4.6	2.0	1.1	2.9	2.6	4.4	1.4	5.8	1.1
2	3.1	4.8	6.4	2.0	2.4	0.7	1.1	1.6	1.4	5.2	11.5	4.5
3	4.6	4.5	8.0	3.0	1.4	1.4	2.0	2.3	2.8	1.3	8.7	0.9
4	4.6	4.8	5.4	1.1	1.8	2.3	3.1	2.5	2.4	3.1	5.1	2.9
5	1.7	2.0	4.0	0.2	1.8	1.6	4.0	1.5	0.8	8.0	4.2	6.4
6	0.9	3.7	6.7	0.3	2.7	1.3	2.7	1.7	1.0	6.5	6.4	4.5
7	4.0	3.1	6.2	0.7	2.6	0.8	3.9	1.5	2.1	3.2	1.6	5.5
8	4.6	5.1	2.7	0.9	0.8	0.6	2.4	2.2	1.1	6.5	0.6	5.2
9	4.1	4.3	5.1	0.9	1.0	0.7	0.9	3.5	2.4	5.2	0.1	1.7
10	5.0	3.9	2.7	1.0	0.7	1.7	0.6	1.9	3.3	1.6	1.7	3.2
11	7.4	4.6	3.0	1.1	1.1	1.4	2.0	1.3	2.2	0.5	2.3	1.5
12	4.8	2.3	4.0	1.2	1.3	1.8	1.9	1.0	0.3	1.9	1.6	2.8
13	4.3	3.7	6.7	1.6	0.9	1.1	2.8	0.7	0.8	1.9	4.8	1.5
14	5.9	4.1	7.0	1.4	1.0	1.2	2.0	2.1	1.8	5.3	2.9	7.2
15	1.5	6.9	3.0	5.5	1.0	2.0	0.9	2.4	4.3	4.2	4.7	5.0
16	3.1	7.5	0.7	5.5	1.3	1.5	1.9	3.0	5.6	1.9	2.7	1.3
17	6.5	3.9	2.8	2.3	2.0	0.9	3.5	4.4	1.6	3.4	1.6	4.2
18	9.2	5.0	4.7	3.0	2.6	1.1	2.5	0.8	3.1	3.5	4.4	2.3
19	6.2	5.5	4.7	7.6	2.0	1.0	3.6	3.8	1.7	3.0	4.4	0.2
20	5.0	5.8	2.6	9.3	1.1	0.8	3.7	2.6	2.1	1.6	4.3	2.1
21	5.4	4.4	4.5	5.9	0.5	1.0	2.3	0.8	1.1	3.6	0.7	1.7
22	4.7	6.5	7.4	5.0	0.6	2.2	3.2	2.5	3.0	3.3	0.4	4.4
23	9.0	4.1	9.6	2.9	1.1	2.3	2.6	1.9	3.9	4.7	4.8	1.4
24	5.6	2.4	7.6	1.2	1.6	0.9	2.6	2.4	2.4	4.8	11.0	2.8
25	3.7	3.4	3.6	0.7	1.2	1.0	1.9	1.1	2.5	4.8	6.4	2.4
26	5.2	2.9	5.5	1.0	1.9	2.4	1.9	1.9	4.2	1.8	2.7	0.8
27	7.5	4.9	8.1	1.4	1.6	3.6	1.8	1.9	1.8	5.1	6.8	1.0
28	4.1	2.6	11.7	1.0	0.9	4.0	2.6	0.8	0.5	7.3	2.6	2.1
29	1.4		5.5	1.6	1.4	3.0	2.6	1.2	2.4	5.8	1.7	1.1
30	3.9		3.8	3.3	1.5	3.9	1.7	1.0	3.7	1.3	8.6	2.4
31	8.0		5.0		1.7		2.3	5.4		1.4		3.3
0 AVER	4.8	4.3	5.3	2.6	1.5	1.6	2.4	2.1	2.3	3.6	4.2	2.8

AVER of monthly values 3.12467E+00

ESSEX - AVG. DAILY WIND SPEED (M/S)

Annual data display: Summary for period ending 1992/ 6

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	2.2	1.7	2.4	2.0	5.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
2	0.3	1.1	1.3	3.8	3.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0
3	0.8	0.6	1.0	3.4	2.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0
4	1.8	2.0	0.8	1.8	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0
5	4.3	1.0	0.7	0.8	1.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0
6	5.6	1.6	2.9	2.3	0.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0
7	1.6	1.2	0.2	3.1	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	1.8	1.7	0.3	1.2	3.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0
9	3.3	1.1	2.9	1.1	0.9	1.8	0.0	0.0	0.0	0.0	0.0	0.0
10	1.4	1.9	1.3	3.3	0.3	0.8	0.0	0.0	0.0	0.0	0.0	0.0
11	1.4	1.9	0.0	3.8	3.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0
12	3.3	1.0	0.6	2.8	3.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0
13	0.7	0.5	0.9	1.0	3.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0
14	7.1	0.8	0.8	0.6	0.8	3.0	0.0	0.0	0.0	0.0	0.0	0.0
15	2.6	1.4	2.1	3.4	1.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0
16	4.9	1.0	4.1	3.3	2.5	0.9	0.0	0.0	0.0	0.0	0.0	0.0
17	6.3	0.8	2.9	0.2	4.4	4.4	0.0	0.0	0.0	0.0	0.0	0.0
18	3.7	0.8	3.4	1.7	4.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0
19	4.1	1.2	1.9	0.2	1.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
20	2.7	1.7	0.2	2.8	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	3.0	1.7	0.1	3.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	1.4	0.5	5.1	3.5	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	2.1	1.8	0.6	2.3	4.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0
24	3.1	2.1	2.2	0.5	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	1.1	1.2	3.7	0.3	0.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0
26	0.9	1.6	1.8	0.5	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0
27	1.2	1.9	4.9	2.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.8	2.5	2.1	0.8	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0
29	1.8	2.5	0.6	3.9	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	1.8		0.6	1.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	1.4		3.2		1.1		0.0	0.0		0.0		0.0
0 AVER	2.5	1.4	1.8	2.1	2.1	0.8	0.0	0.0	0.0	0.0	0.0	0.0

AVER of monthly values 8.88355E-01

KETTLE CK. - AVG. DAILY WIND SPEED (M/S)

Annual data display: Summary for period ending 1989/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	3.3	5.7	6.2	4.6	3.6	2.4	0.1	0.9	2.0	2.7	4.0	0.8
2	5.4	6.0	2.3	4.1	3.7	3.2	0.2	2.8	1.4	3.8	2.0	5.6
3	3.3	5.1	8.6	2.7	3.5	3.4	0.8	3.0	0.6	3.2	1.4	5.7
4	2.5	2.9	3.2	3.8	3.5	3.5	0.1	3.0	2.8	2.3	2.3	1.5
5	3.5	2.0	6.7	2.9	5.3	1.6	1.3	1.4	2.3	1.8	3.3	1.3
6	5.9	3.8	8.5	3.9	4.7	3.1	0.2	2.6	0.3	3.2	3.9	3.9
7	4.2	4.8	7.8	3.4	7.1	2.7	1.0	1.9	0.8	1.6	2.1	3.4
8	8.4	8.2	3.1	1.9	5.0	1.4	1.7	1.0	2.2	1.3	2.7	0.2
9	4.8	7.4	1.0	4.3	3.4	1.9	2.2	1.9	3.0	0.9	3.7	1.6
10	5.6	6.4	1.4	5.6	5.6	2.7	3.7	1.0	2.0	3.5	1.6	2.4
11	3.6	5.1	2.1	2.9	5.9	2.1	2.3	0.0	0.8	2.7	6.8	0.9
12	5.4	4.5	4.5	3.0	2.7	3.0	1.4	0.2	0.6	2.7	2.1	0.6
13	5.1	5.4	2.5	3.0	2.8	2.5	2.9	0.9	2.5	0.5	5.3	2.1
14	3.5	3.0	3.6	4.4	2.5	2.8	2.6	1.4	3.5	1.0	1.8	3.7
15	3.7	2.7	5.6	2.9	1.1	2.0	0.6	1.9	1.2	0.4	5.9	4.0
16	4.3	5.0	5.8	3.0	2.8	2.8	0.5	1.1	2.8	3.7	8.1	3.9
17	5.3	2.8	4.6	4.8	3.0	3.2	1.1	2.1	2.3	3.9	6.1	2.3
18	4.6	1.9	0.0	2.3	1.9	3.4	1.3	2.3	0.2	4.4	6.3	1.7
19	5.4	3.6	0.0	2.8	2.8	1.1	1.3	1.0	0.3	7.0	4.9	0.3
20	6.8	1.7	0.0	2.7	3.8	0.9	5.3	2.7	0.0	1.5	7.7	4.3
21	3.9	3.2	0.0	3.8	3.9	1.7	3.0	1.3	0.4	3.0	5.2	6.7
22	5.8	5.1	1.4	3.7	2.0	0.9	0.2	1.1	2.5	2.3	0.0	3.2
23	3.5	6.7	2.7	3.4	4.7	0.5	0.3	1.6	3.7	0.9	0.8	1.4
24	2.1	2.0	2.2	2.4	2.5	0.4	0.1	2.5	0.8	0.3	3.6	4.0
25	6.5	2.6	3.5	1.8	2.9	0.3	0.6	1.6	1.5	0.3	4.6	6.3
26	4.7	2.7	2.9	2.4	4.8	0.4	1.0	0.7	3.5	0.0	1.5	5.8
27	4.6	3.5	4.8	3.2	3.0	1.4	1.2	0.7	0.8	0.6	3.8	3.0
28	4.3	3.2	6.2	3.6	1.6	3.6	3.2	0.6	2.3	0.7	7.0	3.0
29	2.8		4.8	4.3	3.1	2.2	0.8	2.6	2.5	0.6	4.0	6.0
30	4.2		4.5	2.2	3.4	0.5	1.1	1.4	0.6	1.1	5.1	5.6
31	7.5		6.0		3.7		1.7	1.7		4.0		4.5
AVER	4.7	4.2	3.8	3.3	3.6	2.0	1.4	1.6	1.7	2.1	3.9	3.2

AVER of monthly values 2.95570E+00

KETTLE CK. - AVG. DAILY WIND SPEED (M/S)

Annual data display: Summary for period ending 1990/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	5.9	3.7	2.5	1.3	5.7	3.4	3.8	2.6	1.9	2.8	1.0	5.6
2	5.7	4.1	2.6	3.3	1.8	5.9	2.3	1.0	2.6	2.4	3.6	3.7
3	5.4	3.9	1.7	3.3	2.1	7.2	1.8	1.1	2.1	3.9	2.4	6.4
4	5.2	4.0	1.1	7.8	6.4	3.9	2.3	2.0	1.7	5.6	3.6	8.5
5	1.7	6.1	2.0	5.0	5.2	3.0	1.2	2.4	2.3	4.3	5.8	5.9
6	2.2	2.2	1.8	2.0	3.5	4.0	1.4	3.4	1.5	5.5	5.6	3.6
7	4.2	1.3	1.8	3.2	4.7	2.1	0.6	1.7	3.1	3.2	2.7	3.8
8	3.2	5.6	1.8	3.2	6.0	2.6	1.8	1.3	2.2	3.5	1.5	1.8
9	3.2	3.9	0.7	5.3	4.7	3.2	1.0	0.8	1.4	4.3	2.1	3.6
10	5.2	4.9	0.7	4.1	8.7	4.2	0.9	1.2	1.8	4.6	2.5	4.9
11	8.1	2.0	1.8	5.5	5.4	2.9	0.7	1.1	1.5	2.0	6.0	1.8
12	7.9	3.0	1.8	3.2	2.0	2.6	2.1	1.1	1.0	1.8	5.5	4.5
13	4.7	6.4	1.8	3.0	4.2	5.2	2.1	1.9	1.1	1.6	3.3	6.4
14	3.3	5.5	1.4	4.4	1.8	2.6	1.9	1.6	4.1	2.6	3.4	1.7
15	3.1	7.6	1.5	3.6	1.8	3.8	1.1	2.9	3.0	3.6	4.9	1.9
16	1.5	3.0	1.1	2.8	3.8	2.1	1.7	1.7	2.9	2.1	6.0	3.7
17	4.5	4.7	2.4	7.0	6.3	4.0	1.8	1.9	2.9	5.3	3.5	2.0
18	5.7	4.2	2.2	4.0	5.9	5.3	1.8	1.3	0.9	7.2	1.0	3.3
19	2.7	6.0	1.6	3.2	3.1	3.7	1.0	5.2	1.5	3.8	0.7	2.8
20	2.3	2.8	1.6	3.4	5.0	2.5	0.9	3.6	1.3	2.1	0.5	3.6
21	4.0	1.6	1.2	2.6	3.9	4.2	0.8	3.6	1.7	3.3	3.0	0.9
22	5.3	0.9	2.2	1.6	3.1	2.3	0.9	2.9	3.7	1.7	3.1	4.1
23	3.2	1.4	2.7	1.1	2.7	6.3	1.0	2.4	3.9	1.9	4.5	3.3
24	5.0	2.2	1.1	2.6	1.6	2.9	0.5	0.4	3.7	1.6	3.7	3.9
25	6.9	1.8	2.1	2.8	1.7	2.5	0.3	0.9	4.8	4.1	3.9	6.2
26	5.4	1.6	2.3	3.4	3.1	3.3	0.6	1.4	2.3	2.4	2.6	3.8
27	6.9	2.1	1.0	2.2	2.2	2.1	0.7	2.5	1.2	3.9	6.3	2.3
28	4.3	1.5	0.5	3.2	2.2	2.3	0.8	2.8	0.9	5.7	7.4	2.8
29	4.3		4.9	1.9	4.1	3.1	0.9	2.1	2.3	0.8	4.3	3.8
30	3.0		2.9	2.8	3.9	2.0	1.4	1.6	3.0	1.9	5.3	4.0
31	2.0		2.8		2.3		2.4	0.8		2.3		3.1
AVER	4.4	3.5	1.9	3.4	3.8	3.5	1.4	2.0	2.3	3.3	3.7	3.8

AVER of monthly values 3.07293E+00

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                              KETTLE CK. - AVG. DAILY WIND SPEED (M/S)

                                Annual data display: Summary for period ending 1991/12

   Day      JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

     1      4.3      1.7      3.1      3.8      2.8      1.1      1.7      3.4      3.4      1.8      3.7      2.1
     2      1.6      2.9      4.5      3.3      4.4      0.4      1.8      2.1      1.6      5.3      7.3      6.3
     3      3.4      3.3      4.6      0.3      3.6      2.5      1.6      2.1      2.7      1.0      5.0      3.7
     4      2.6      2.8      0.5      0.5      1.8      4.4      1.8      3.9      3.5      3.0      2.1      5.3
     5      0.3      1.9      1.8      2.9      5.1      2.9      1.7      3.3      0.7      5.5      3.4      3.5

     6      1.0      0.8      5.0      3.7      5.0      1.4      1.7      1.8      1.1      4.6      6.3      3.9
     7      3.0      2.7      5.7      4.0      4.6      1.1      2.4      2.3      1.9      3.0      0.4      4.8
     8      4.0      3.9      0.4      3.1      0.4      0.7      4.2      1.9      0.3      5.5      1.1      4.4
     9      4.0      2.0      2.3      3.4      0.7      1.6      1.7      3.5      2.2      3.9      0.1      3.2
    10      3.5      4.1      3.3      6.9      1.2      3.8      0.8      4.7      4.3      2.4      1.5      3.7

    11      7.0      3.5      3.8      4.4      1.5      1.8      2.0      4.3      2.9      0.6      2.8      1.6
    12      4.4      2.5      0.6      4.4      1.3      3.0      1.2      2.5      0.8      2.4      2.0      4.7
    13      2.6      2.8      5.4      6.3      1.6      0.7      3.3      0.7      0.6      2.6      4.5      3.3
    14      6.4      4.2      3.3      4.6      1.7      1.9      3.8      1.9      1.1      3.7      1.9      5.3
    15      2.0      6.7      0.7      6.7      0.9      3.1      1.2      2.7      3.1      3.6      4.7      5.8

    16      3.6      6.0      0.3      4.2      3.0      2.5      1.9      2.9      4.2      1.6      5.5      2.8
    17      5.3      2.4      1.3      2.3      3.5      1.4      3.0      3.8      2.1      1.4      0.8      5.0
    18      5.8      3.6      3.6      1.9      6.5      2.0      1.9      2.2      3.5      2.3      3.0      3.6
    19      5.3      4.0      3.8      6.9      4.5      0.5      2.6      4.0      3.0      3.4      4.1      0.8
    20      3.9      4.8      0.7      7.4      1.5      1.1      1.7      3.1      2.5      1.5      4.3      3.4

    21      4.2      2.9      3.8      5.3      0.7      1.8      2.2      2.6      0.6      3.1      1.2      3.8
    22      4.0      7.0      6.8      4.0      0.8      4.8      2.9      2.7      2.2      1.0      1.7      4.6
    23      8.5      2.4      6.2      2.9      1.0      4.1      3.7      1.7      4.0      2.4      2.6      4.5
    24      4.2      0.3      5.0      1.0      2.7      1.1      2.3      3.8      1.7      3.3      7.1      2.9
    25      2.8      2.4      2.5      1.2      0.4      0.9      3.1      1.8      2.5      4.7      6.0      1.8

    26      4.7      1.9      3.4      0.8      3.7      2.4      2.7      2.4      4.9      1.3      2.8      2.4
    27      7.0      3.4      6.6      2.1      2.5      3.2      2.6      1.7      3.3      4.0      5.8      0.1
    28      3.8      1.0      8.0      3.3      1.2      3.4      2.0      1.3      1.4      6.8      3.2      1.2
    29      0.9               5.7      3.8      1.7      2.1      3.1      1.1      1.9      3.8      2.3      2.0
    30      1.5               2.7      6.4      2.5      1.6      2.9      1.6      4.3      1.8      7.7      2.3
    31      5.2               3.3               2.5               3.1      4.3               1.5               0.8
0 AVER      3.9      3.1      3.5      3.7      2.4      2.1      2.3      2.6      2.4      3.0      3.5      3.3

  AVER of monthly values  3.00401E+00
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                              KETTLE CK. - AVG. DAILY WIND SPEED (M/S)

                                Annual data display: Summary for period ending 1992/ 6

   Day      JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

     1      0.1      4.5      4.2      4.4      4.1      4.1      0.0      0.0      0.0      0.0      0.0      0.0
     2      0.7      0.4      5.7      5.7      5.0      2.2      0.0      0.0      0.0      0.0      0.0      0.0
     3      2.2      0.4      0.4      3.3      4.8      1.9      0.0      0.0      0.0      0.0      0.0      0.0
     4      2.7      7.3      1.6      2.6      3.3      3.0      0.0      0.0      0.0      0.0      0.0      0.0
     5      3.3      0.2      3.9      4.6      2.8      3.4      0.0      0.0      0.0      0.0      0.0      0.0

     6      2.9      1.8      6.5      2.9      2.1      2.4      0.0      0.0      0.0      0.0      0.0      0.0
     7      3.9      1.0      2.0      3.9      1.1      1.9      0.0      0.0      0.0      0.0      0.0      0.0
     8      1.9      3.0      1.9      3.1      5.1      3.9      0.0      0.0      0.0      0.0      0.0      0.0
     9      4.1      4.1      3.5      1.6      3.4      3.8      0.0      0.0      0.0      0.0      0.0      0.0
    10      4.0      2.8      6.3      3.7      2.2      3.4      0.0      0.0      0.0      0.0      0.0      0.0

    11      1.8      5.7      9.0      3.9      2.2      2.0      0.0      0.0      0.0      0.0      0.0      0.0
    12      5.1      0.2      6.0      6.4      3.2      2.2      0.0      0.0      0.0      0.0      0.0      0.0
    13      3.0      0.1      5.2      1.7      4.7      3.3      0.0      0.0      0.0      0.0      0.0      0.0
    14      9.7      0.5      3.9      2.2      2.8      3.4      0.0      0.0      0.0      0.0      0.0      0.0
    15      3.0      2.6      3.6      3.5      2.0      3.4      0.0      0.0      0.0      0.0      0.0      0.0

    16      4.3      4.6      5.0      3.4      2.4      3.2      0.0      0.0      0.0      0.0      0.0      0.0
    17      6.9      1.7      5.4      2.2      5.3      4.9      0.0      0.0      0.0      0.0      0.0      0.0
    18      5.5      3.5      3.2      3.9      3.7      5.5      0.0      0.0      0.0      0.0      0.0      0.0
    19      4.1      2.9      5.3      3.6      2.4      5.5      0.0      0.0      0.0      0.0      0.0      0.0
    20      2.0      5.4      3.2      3.4      2.1      5.2      0.0      0.0      0.0      0.0      0.0      0.0

    21      2.7      4.1      2.4      3.6      1.7      5.1      0.0      0.0      0.0      0.0      0.0      0.0
    22      3.3      0.4      4.9      4.9      2.1      2.6      0.0      0.0      0.0      0.0      0.0      0.0
    23      4.6      3.4      2.9      2.9      4.2      2.2      0.0      0.0      0.0      0.0      0.0      0.0
    24      7.3      6.0      2.5      3.8      4.7      1.6      0.0      0.0      0.0      0.0      0.0      0.0
    25      1.6      3.1      4.7      1.8      2.8      1.5      0.0      0.0      0.0      0.0      0.0      0.0

    26      0.9      3.8      2.3      3.0      2.6      1.9      0.0      0.0      0.0      0.0      0.0      0.0
    27      1.3      4.9      7.8      4.4      3.6      4.5      0.0      0.0      0.0      0.0      0.0      0.0
    28      0.8      6.3      6.8      2.6      2.4      1.8      0.0      0.0      0.0      0.0      0.0      0.0
    29      4.4      4.3      1.9      4.2      1.8      3.0      0.0      0.0      0.0      0.0      0.0      0.0
    30      4.7               2.2      3.8      3.0      3.0      0.0      0.0      0.0      0.0      0.0      0.0
    31      5.1               3.3               3.4               0.0      0.0               0.0               0.0
0 AVER      3.5      3.1      4.1      3.5      3.1      3.2      0.0      0.0      0.0      0.0      0.0      0.0

  AVER of monthly values  1.70629E+00
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                         PITTOCK -  AVG. DAILY WIND SPEED (M/S)

                         Annual data display: Summary for period ending 1991/12

  Day       JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

    1       2.2      1.4      1.7      1.4      1.5      0.7      0.9      1.6      1.7      1.2      2.5      1.6
    2       1.4      1.8      2.3      1.3      2.2      0.6      1.0      0.7      1.2      2.2      3.7      2.7
    3       2.0      1.6      2.0      0.7      1.7      1.2      0.9      1.1      1.5      0.8      3.0      2.4
    4       2.2      1.7      2.2      1.0      1.0      1.6      1.0      1.3      1.4      1.9      1.6      1.8
    5       0.6      1.1      1.1      1.6      2.5      0.9      0.8      1.2      0.4      2.9      1.8      1.7

    6       0.6      0.6      2.4      2.0      2.1      0.6      0.7      0.5      0.6      2.6      2.5      1.7
    7       1.3      1.1      2.8      1.8      2.4      0.3      1.1      0.6      0.8      1.7      0.6      2.5
    8       2.6      1.8      0.7      1.6      0.7      0.6      1.5      0.7      0.4      2.2      0.8      1.8
    9       1.8      1.2      1.6      1.3      0.7      0.7      0.8      1.2      1.3      1.8      0.5      1.5
   10       1.8      1.8      1.4      3.1      0.5      1.7      0.4      1.4      1.9      1.2      1.1      1.9

   11       4.1      1.8      1.6      1.6      0.8      1.1      0.6      1.4      1.2      0.6      1.5      1.2
   12       1.5      1.9      0.9      1.7      0.9      1.4      0.7      0.6      0.5      1.0      1.2      2.1
   13       1.3      1.9      2.1      2.7      0.7      0.5      1.1      0.2      0.6      1.1      2.2      1.4
   14       2.7      1.7      1.7      2.9      0.7      1.0      1.1      0.7      0.8      1.7      1.1      2.6
   15       1.2      2.8      1.0      2.9      0.5      1.3      0.3      0.9      1.9      1.8      1.9      3.1

   16       1.3      2.7      0.5      2.1      1.1      1.3      0.8      1.1      2.4      1.0      2.0      1.8
   17       2.5      1.7      1.2      1.0      1.7      0.7      1.2      1.6      1.4      1.0      0.9      2.6
   18       3.0      2.6      1.7      0.8      2.2      1.0      1.0      1.0      1.5      1.4      1.7      1.7
   19       2.7      2.0      1.5      2.3      2.0      0.5      1.2      1.6      1.2      1.3      1.7      0.6
   20       1.8      2.6      0.7      2.5      1.3      0.5      1.0      1.2      1.3      1.0      1.6      1.2

   21       1.7      2.1      2.4      1.6      0.5      0.7      0.9      1.2      0.5      1.7      0.6      2.1
   22       1.6      3.0      3.3      1.5      0.4      1.7      1.2      1.4      1.4      1.1      0.8      2.4
   23       3.6      1.5      3.7      1.2      0.9      1.5      1.6      0.8      2.2      1.5      1.4      1.9
   24       2.4      0.8      2.4      0.7      1.2      0.8      1.0      1.6      0.7      1.8      3.5      1.5
   25       1.5      1.2      1.2      0.4      0.6      0.2      1.1      1.3      1.2      2.0      2.9      1.0

   26       2.1      1.1      1.9      0.8      1.8      0.8      1.1      1.2      2.4      1.0      1.7      1.2
   27       3.0      1.7      2.5      1.4      1.1      1.5      0.9      1.0      1.7      1.6      2.6      0.2
   28       2.2      1.0      3.3      1.6      0.8      1.3      0.9      0.6      0.9      3.1      1.9      0.7
   29       1.1               1.8      2.2      1.1      0.9      1.5      0.4      0.8      3.0      1.7      0.9
   30       1.0               1.3      2.7      1.3      0.7      1.2      0.8      2.0      1.4      3.4      1.1
   31       2.9               1.9               1.5               1.4      1.6               1.1               0.8
0 AVER      2.0      1.7      1.8      1.7      1.2      0.9      1.0      1.0      1.3      1.6      1.8      1.7

  AVER of monthly values  1.48033E+00
1

                         PITTOCK -  AVG. DAILY WIND SPEED (M/S)

                         Annual data display: Summary for period ending 1992/ 6

  Day       JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

    1       0.3      1.7      2.3      4.4      4.1      4.1      0.0      0.0      0.0      0.0      0.0      0.0
    2       0.9      0.8      2.6      5.7      5.0      2.2      0.0      0.0      0.0      0.0      0.0      0.0
    3       1.8      0.8      0.8      3.3      4.8      1.9      0.0      0.0      0.0      0.0      0.0      0.0
    4       1.1      2.6      1.0      2.6      3.3      3.0      0.0      0.0      0.0      0.0      0.0      0.0
    5       1.2      0.6      1.6      4.6      2.8      3.4      0.0      0.0      0.0      0.0      0.0      0.0

    6       1.5      1.6      3.5      2.9      2.1      2.4      0.0      0.0      0.0      0.0      0.0      0.0
    7       1.6      1.3      1.0      3.9      1.1      1.9      0.0      0.0      0.0      0.0      0.0      0.0
    8       1.5      1.3      0.8      3.1      5.1      3.9      0.0      0.0      0.0      0.0      0.0      0.0
    9       2.0      1.3      1.9      1.6      3.4      3.8      0.0      0.0      0.0      0.0      0.0      0.0
   10       1.6      1.7      2.4      3.7      2.2      3.4      0.0      0.0      0.0      0.0      0.0      0.0

   11       1.3      2.3      3.2      3.9      2.2      2.0      0.0      0.0      0.0      0.0      0.0      0.0
   12       2.0      0.7      3.0      6.4      3.2      2.2      0.0      0.0      0.0      0.0      0.0      0.0
   13       1.7      0.6      2.1      1.7      4.7      3.3      0.0      0.0      0.0      0.0      0.0      0.0
   14       3.2      0.8      1.7      2.2      2.8      3.4      0.0      0.0      0.0      0.0      0.0      0.0
   15       1.6      2.1      1.3      3.5      2.0      3.4      0.0      0.0      0.0      0.0      0.0      0.0

   16       2.1      1.7      1.9      3.4      2.4      3.2      0.0      0.0      0.0      0.0      0.0      0.0
   17       2.8      1.2      2.5      2.2      5.3      4.9      0.0      0.0      0.0      0.0      0.0      0.0
   18       2.7      2.5      1.2      3.9      3.7      5.5      0.0      0.0      0.0      0.0      0.0      0.0
   19       1.9      1.5      2.0      3.6      2.4      5.5      0.0      0.0      0.0      0.0      0.0      0.0
   20       1.1      2.0      1.3      3.4      2.1      5.2      0.0      0.0      0.0      0.0      0.0      0.0

   21       1.7      2.0      1.1      3.6      1.7      5.1      0.0      0.0      0.0      0.0      0.0      0.0
   22       2.3      0.8      1.8      4.9      2.1      2.6      0.0      0.0      0.0      0.0      0.0      0.0
   23       2.4      1.9      1.2      2.9      4.2      2.2      0.0      0.0      0.0      0.0      0.0      0.0
   24       3.2      3.7      1.1      3.8      4.7      1.6      0.0      0.0      0.0      0.0      0.0      0.0
   25       1.3      2.0      2.0      1.8      2.8      1.5      0.0      0.0      0.0      0.0      0.0      0.0

   26       1.1      1.6      1.3      3.0      2.6      1.9      0.0      0.0      0.0      0.0      0.0      0.0
   27       1.3      2.2      2.8      4.4      3.6      4.5      0.0      0.0      0.0      0.0      0.0      0.0
   28       0.6      2.5      2.4      2.6      2.4      1.8      0.0      0.0      0.0      0.0      0.0      0.0
   29       2.0      2.0      1.0      4.2      1.8      3.0      0.0      0.0      0.0      0.0      0.0      0.0
   30       2.0               0.8      3.8      3.0      3.0      0.0      0.0      0.0      0.0      0.0      0.0
   31       1.8               1.3               3.4               0.0      0.0               0.0               0.0
0 AVER      1.7      1.7      1.8      3.5      3.1      3.2      0.0      0.0      0.0      0.0      0.0      0.0

  AVER of monthly values  1.24742E+00
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PITTOCK - AVG. DAILY WIND SPEED (M/S)

Annual data display: Summary for period ending 1989/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	3.0	5.8	7.1	3.8	2.0	3.1	1.2	1.6	3.2	2.1	5.0	1.7
2	6.5	4.9	3.0	5.4	3.6	4.4	1.0	3.7	2.0	4.0	2.2	6.2
3	4.3	4.7	7.3	3.3	3.7	4.0	1.6	4.4	1.3	3.4	1.4	6.4
4	2.2	2.8	2.7	3.6	4.1	4.1	1.4	3.6	2.4	3.9	2.7	2.9
5	4.4	2.8	6.1	3.4	5.4	1.9	1.9	2.4	3.1	3.4	4.7	2.5
6	5.6	4.0	5.8	3.5	4.7	3.7	1.9	3.8	1.2	3.8	4.3	4.9
7	4.2	5.7	5.7	3.1	6.4	3.9	2.9	2.7	1.6	2.5	1.7	2.6
8	9.8	9.1	3.1	1.8	4.8	1.5	1.9	2.1	2.7	2.3	3.4	0.8
9	6.3	8.2	1.2	1.8	2.2	2.2	3.3	2.7	3.6	1.2	4.7	2.1
10	6.3	7.3	2.1	1.8	4.0	1.5	4.5	2.3	2.8	3.5	3.0	3.7
11	4.6	6.5	2.5	4.2	5.9	2.2	2.7	1.3	0.9	3.3	7.1	1.9
12	6.0	4.7	4.4	2.9	2.7	3.4	1.7	0.8	1.2	3.5	2.8	0.5
13	5.3	5.3	2.8	1.9	3.8	3.9	2.4	1.5	1.4	1.7	5.3	1.1
14	3.7	3.3	3.6	1.9	2.7	3.2	3.5	2.3	2.5	2.6	4.4	3.0
15	6.1	2.4	5.9	0.8	0.9	2.5	1.4	2.3	1.3	1.7	5.3	3.9
16	5.1	4.7	5.9	1.2	2.9	3.2	1.0	2.1	2.9	4.1	8.2	5.1
17	6.6	3.7	4.3	1.7	2.9	3.7	2.0	1.5	2.1	3.5	7.4	4.3
18	4.6	2.4	0.0	0.9	1.5	4.0	2.2	2.3	0.8	3.5	6.4	3.7
19	6.1	5.1	0.0	2.0	2.7	1.7	2.1	1.2	1.1	6.5	6.3	2.3
20	6.6	2.3	0.0	4.0	4.0	1.8	4.4	2.8	0.8	2.4	8.4	6.3
21	3.9	3.1	0.0	3.8	5.2	2.4	2.9	2.8	1.3	2.3	6.0	4.8
22	6.5	4.4	0.9	3.8	2.8	1.7	1.3	2.1	3.1	3.1	1.1	2.1
23	4.8	5.7	3.0	3.5	3.2	1.5	0.8	2.3	5.4	2.7	2.7	2.3
24	2.7	1.7	2.6	2.4	2.4	1.6	0.9	1.9	1.5	1.6	4.6	5.1
25	7.4	3.0	3.1	1.9	3.7	1.6	1.7	1.8	1.9	1.4	5.8	7.5
26	4.1	1.7	3.5	2.2	5.4	2.1	2.3	1.0	3.9	1.4	3.4	5.3
27	5.0	3.5	4.8	1.9	4.3	2.8	2.7	0.8	1.1	1.3	4.2	3.1
28	5.7	3.1	6.8	2.4	3.1	4.6	3.3	0.9	3.3	1.7	6.9	3.5
29	3.7		4.7	4.4	3.9	2.5	1.0	3.1	3.5	1.7	5.1	4.8
30	5.8		3.7	2.4	3.4	1.3	0.8	2.9	1.0	2.3	6.3	3.5
31	7.9		5.1		4.5		2.0	2.3		3.7		4.1
AVER	5.3	4.4	3.6	2.7	3.6	2.7	2.1	2.2	2.2	2.8	4.7	3.6

AVER of monthly values 3.32905E+00

PITTOCK - AVG. DAILY WIND SPEED (M/S)

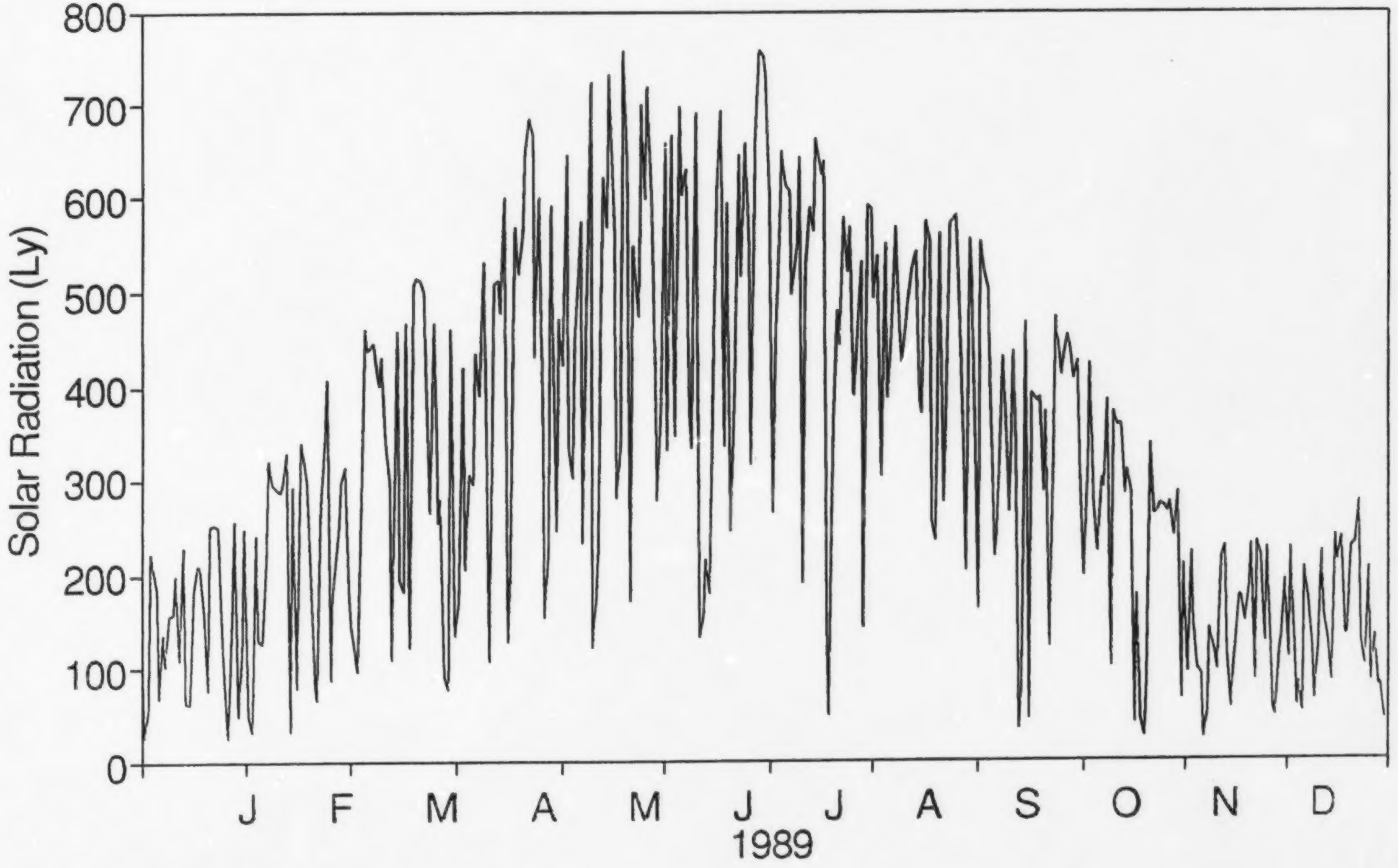
Annual data display: Summary for period ending 1990/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	5.6	4.8	6.9	2.0	2.3	4.1	2.5	3.0	1.9	3.6	2.1	6.8
2	7.4	3.5	6.6	3.2	1.1	6.3	3.8	4.0	2.3	2.8	5.0	3.3
3	5.7	4.1	5.2	3.0	1.5	8.1	2.2	1.7	1.4	3.8	4.0	6.0
4	6.1	2.7	2.4	6.5	5.5	3.2	4.5	0.5	1.8	5.9	3.6	8.9
5	2.8	6.8	3.5	4.9	5.1	2.7	6.1	0.8	2.1	5.1	6.2	5.6
6	3.5	3.4	3.5	2.3	3.7	2.9	2.7	1.2	1.6	5.3	5.9	4.6
7	6.3	2.3	3.4	3.8	5.3	4.8	2.6	1.0	3.1	2.8	3.6	4.5
8	3.6	6.1	3.0	4.3	5.4	2.4	1.1	0.8	1.8	3.2	1.7	3.3
9	3.8	4.2	1.5	6.2	5.2	2.6	3.8	1.3	0.7	3.8	2.7	5.6
10	3.5	4.9	1.8	3.9	9.3	4.4	2.7	0.8	2.3	5.3	3.2	4.4
11	8.3	1.2	3.0	5.7	6.1	4.8	1.0	1.2	1.0	1.9	7.0	2.6
12	7.0	3.1	3.3	3.5	3.6	2.4	2.1	0.9	1.4	1.0	5.3	4.7
13	5.4	6.2	4.5	3.9	3.2	4.2	3.2	1.5	1.3	1.4	3.6	7.0
14	3.1	4.6	3.1	4.7	2.1	5.7	2.2	1.6	3.5	2.3	4.2	1.9
15	4.1	4.6	2.6	4.3	1.6	3.4	2.6	2.7	3.2	4.1	6.3	2.6
16	1.7	1.6	3.0	3.6	3.1	3.5	1.7	1.2	2.5	2.3	6.6	4.2
17	4.4	2.0	5.2	6.5	6.6	1.5	3.3	2.0	2.5	4.7	3.8	2.6
18	4.9	1.9	5.7	5.2	6.6	4.4	2.7	1.4	1.4	8.2	1.3	4.0
19	2.8	2.5	3.9	4.8	3.2	4.1	3.6	4.0	1.0	3.9	0.7	3.4
20	2.1	1.4	3.5	3.6	5.2	2.9	1.8	3.0	2.1	2.3	1.6	4.3
21	4.3	3.8	3.0	2.3	3.1	2.2	2.4	3.0	1.3	3.8	2.9	1.6
22	6.0	2.5	6.0	2.5	2.2	4.7	2.6	2.4	3.4	1.8	3.8	3.6
23	3.7	0.6	6.3	2.1	2.2	2.7	2.1	1.7	4.1	1.7	5.8	3.3
24	5.6	0.3	2.6	2.6	1.1	5.5	1.4	0.6	2.7	2.2	4.9	5.6
25	6.9	1.8	5.5	2.6	1.2	3.8	2.7	1.0	3.7	3.9	4.8	8.0
26	6.2	4.2	5.5	2.8	1.7	3.0	1.0	1.9	2.1	2.4	3.5	5.9
27	7.1	5.2	3.1	2.8	0.9	4.4	0.7	2.2	1.5	4.4	6.4	3.1
28	5.7	3.8	1.6	4.0	1.1	2.5	0.8	2.7	1.9	5.2	7.7	3.8
29	3.1		4.4	2.9	3.3	2.1	0.7	1.9	2.1	2.1	5.5	4.0
30	4.1		2.6	2.9	4.1	3.2	0.7	1.1	2.7	2.7	5.5	1.3
31	2.2		2.2		3.3		1.1	0.6		2.7		1.2
0 **AVER**	4.7	3.4	3.8	3.8	3.5	3.8	2.3	1.7	2.1	3.4	4.3	4.2

AVER of monthly values 3.43040E+00

Essex Watershed

Solar Radiation 1989



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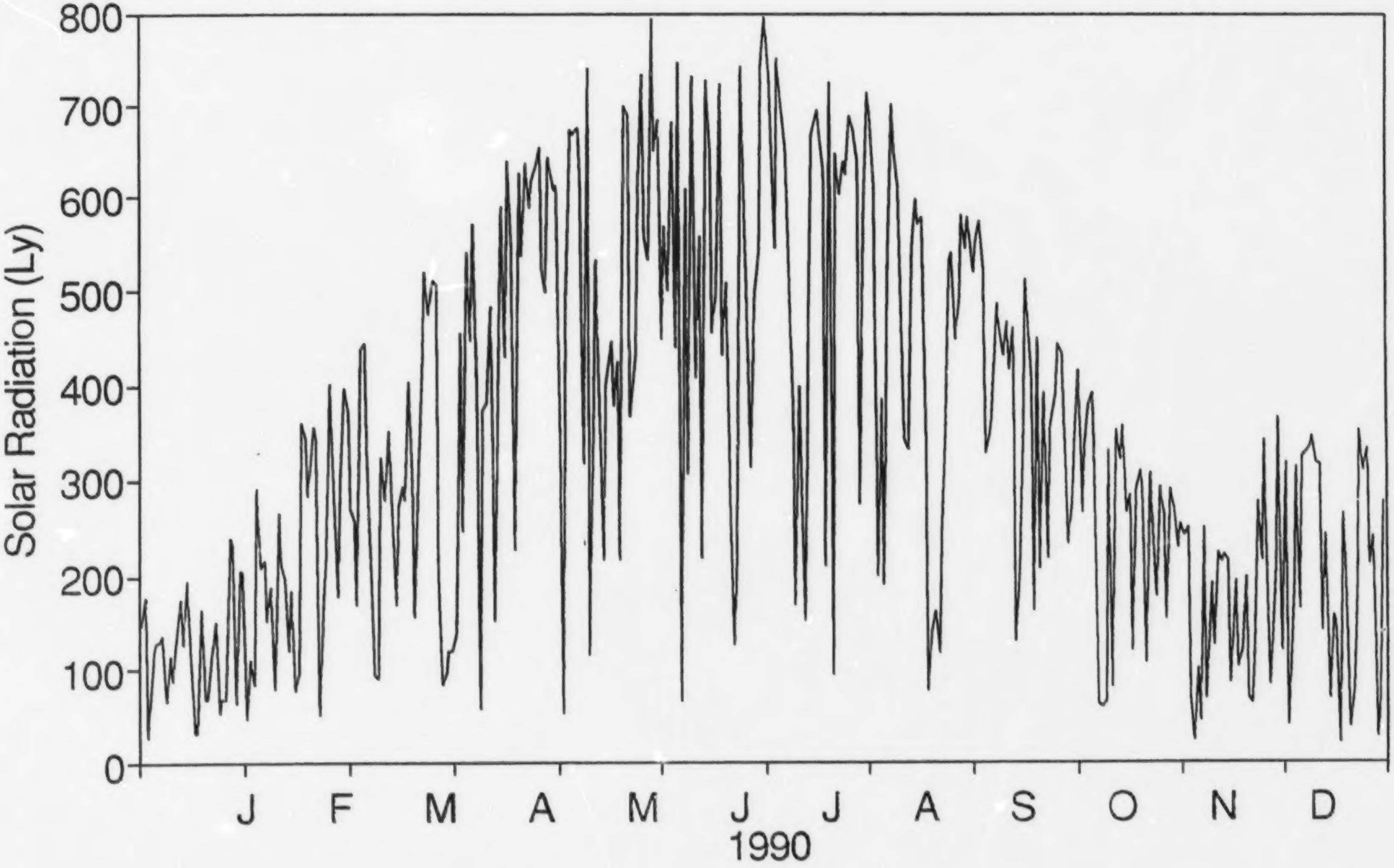

Essex Watershed

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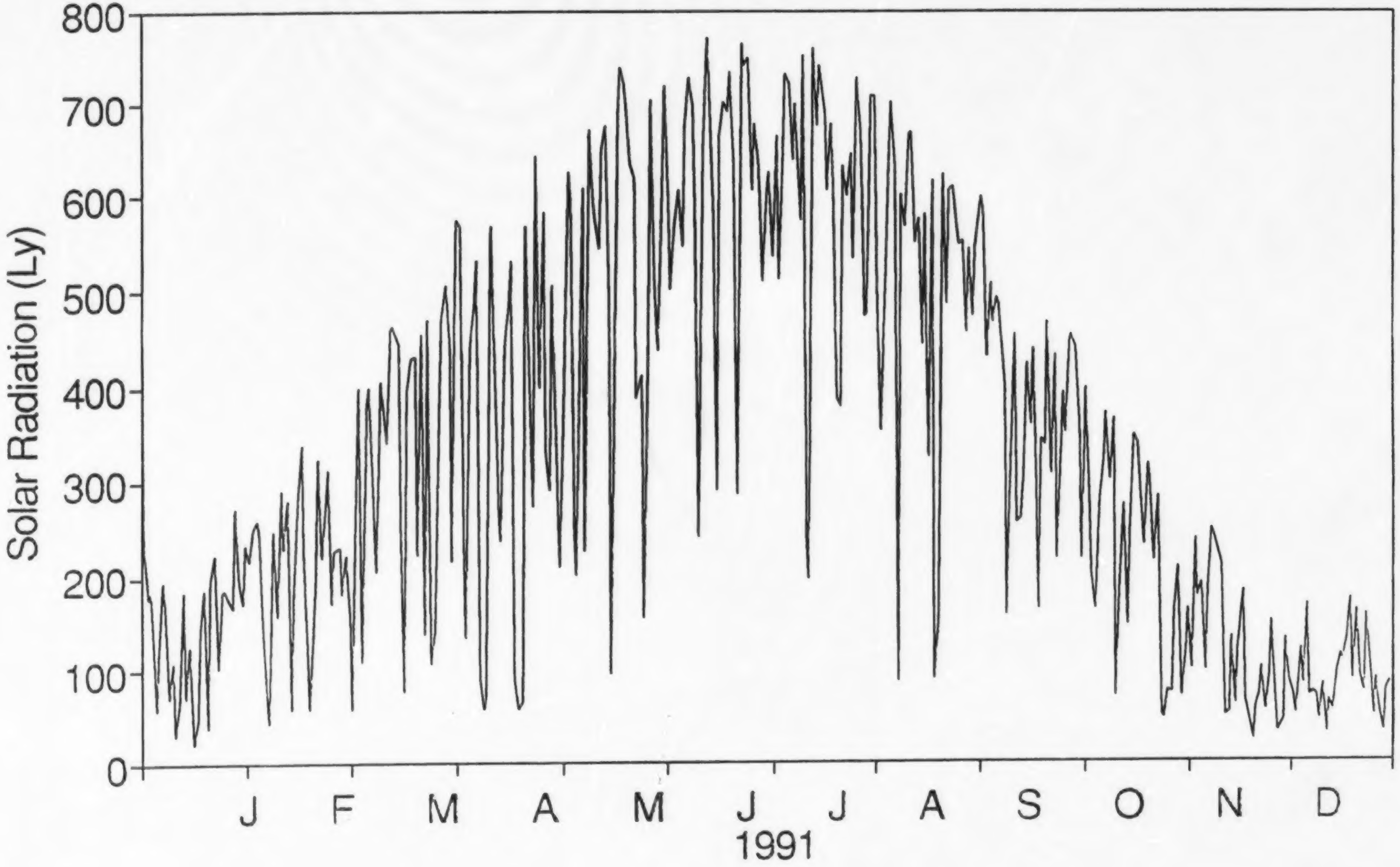

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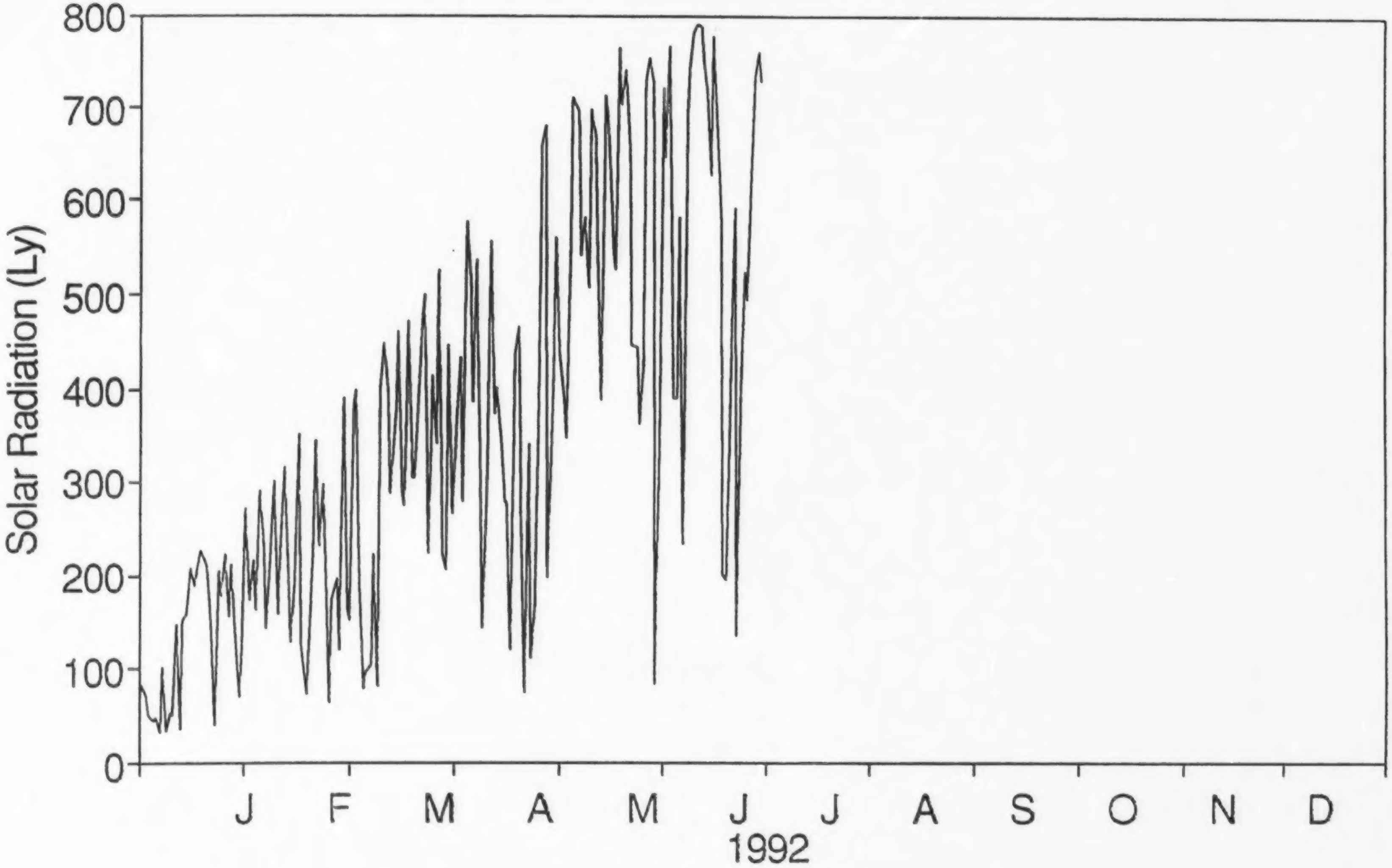

Kettle Creek Watershed
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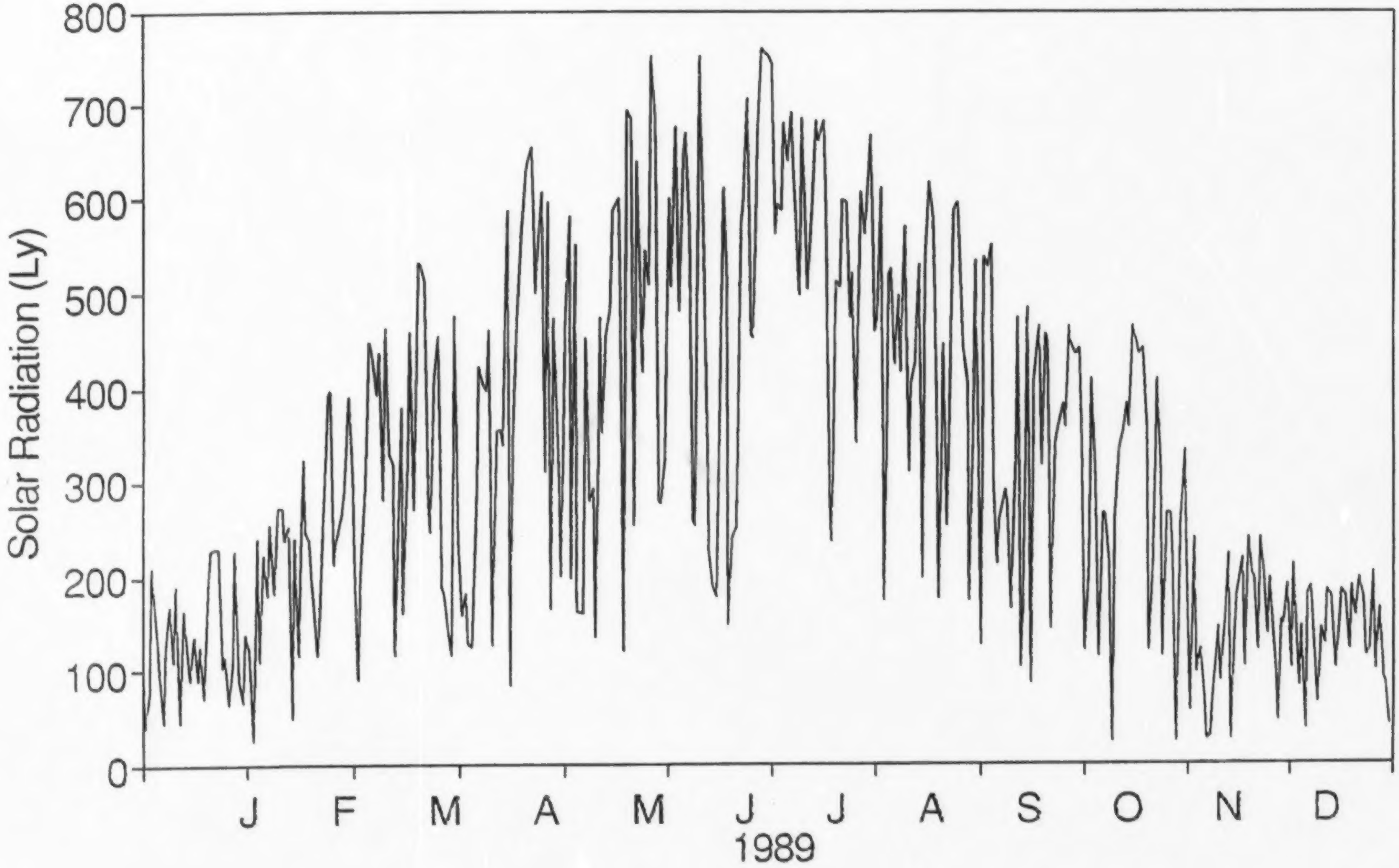

Kettle Creek Watershed

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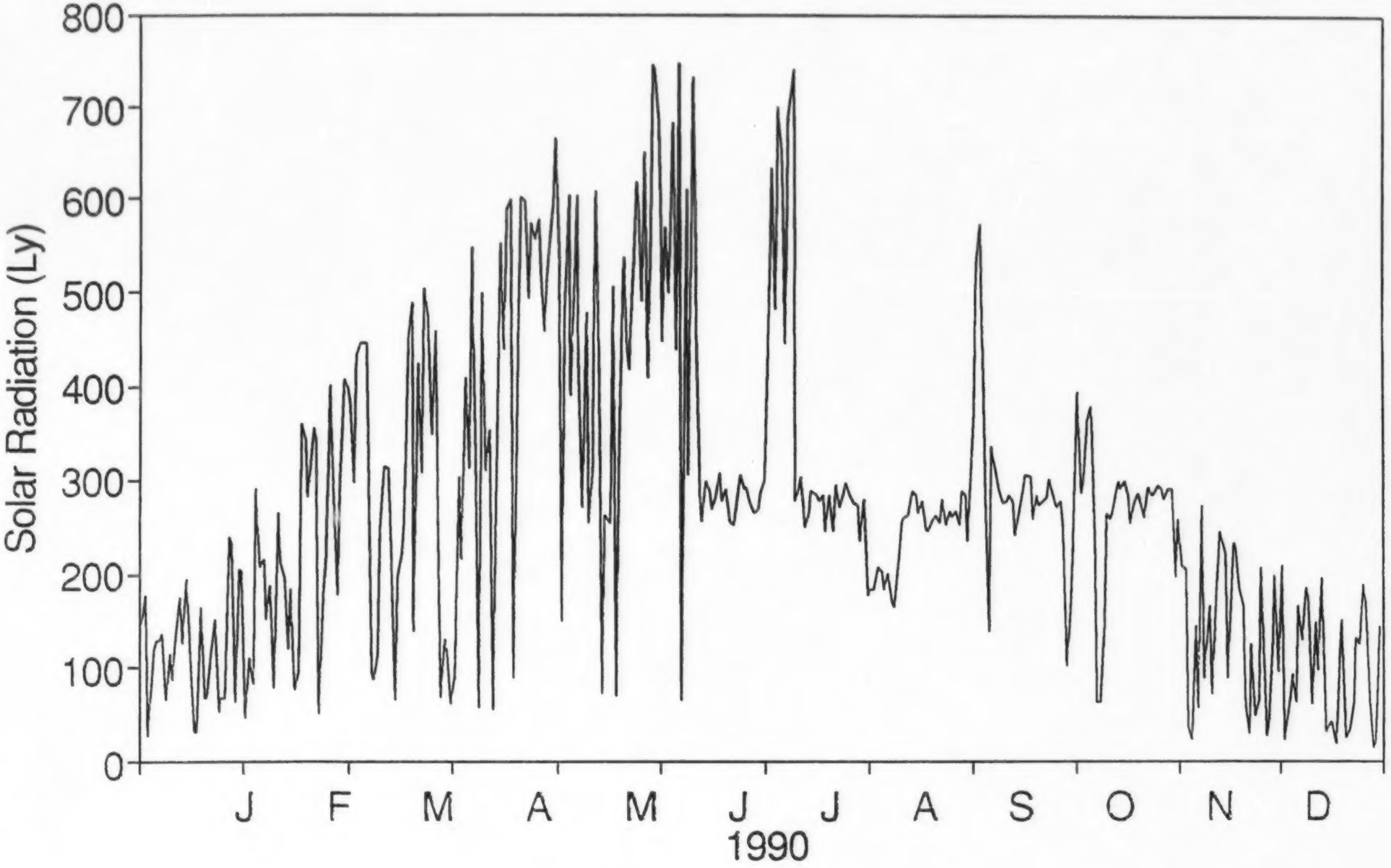

Essex Watershed

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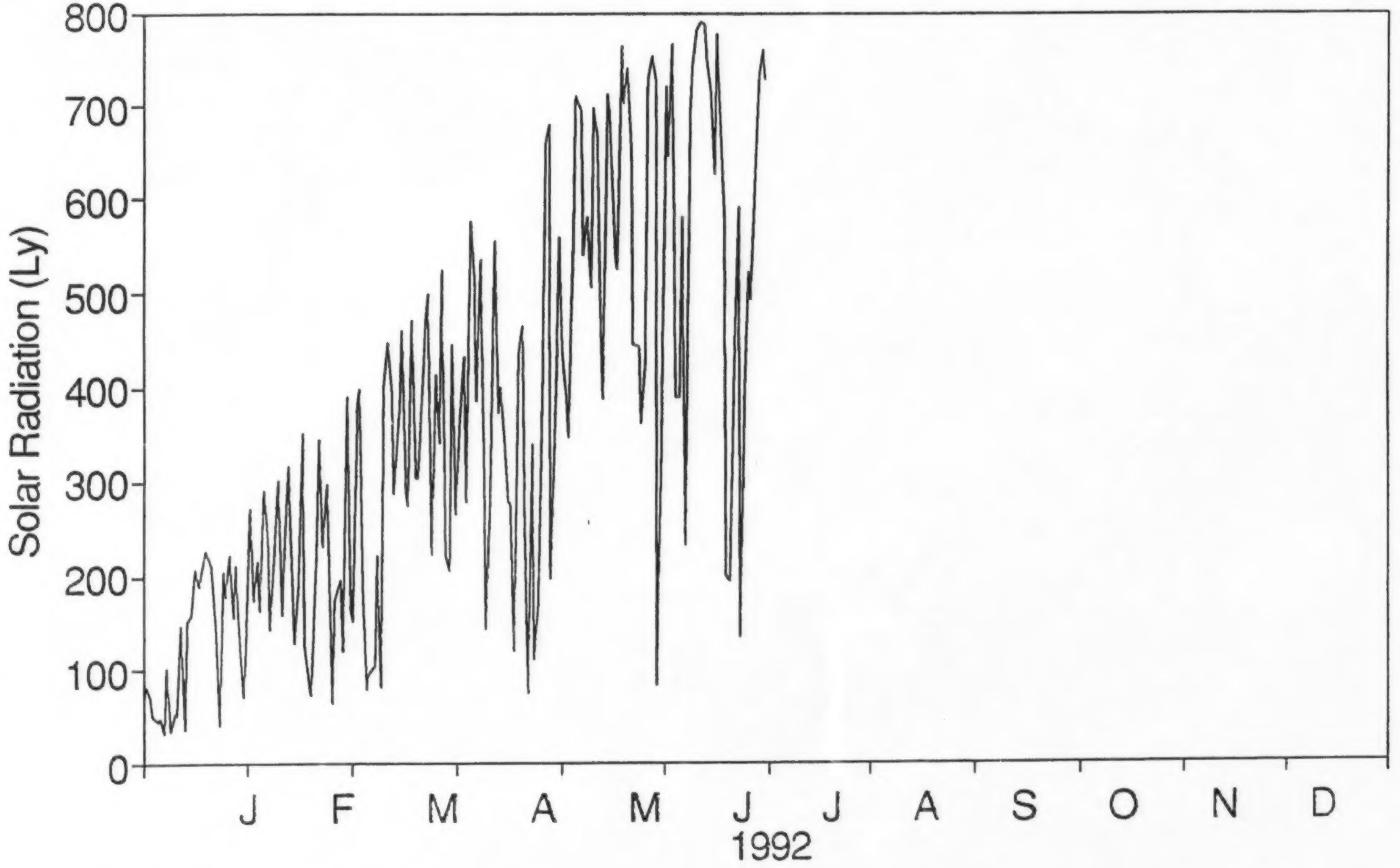

Kettle Creek Watershed

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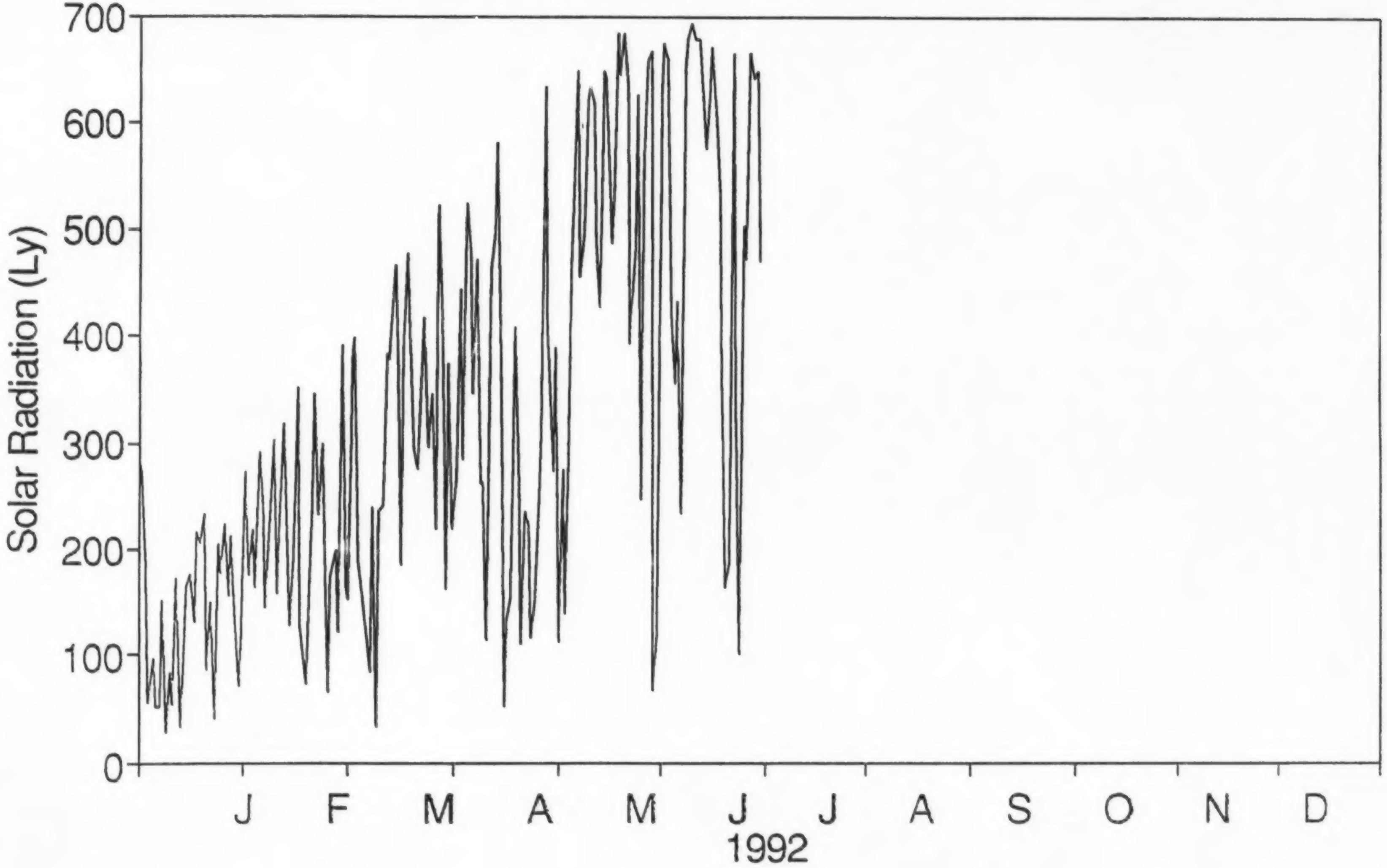
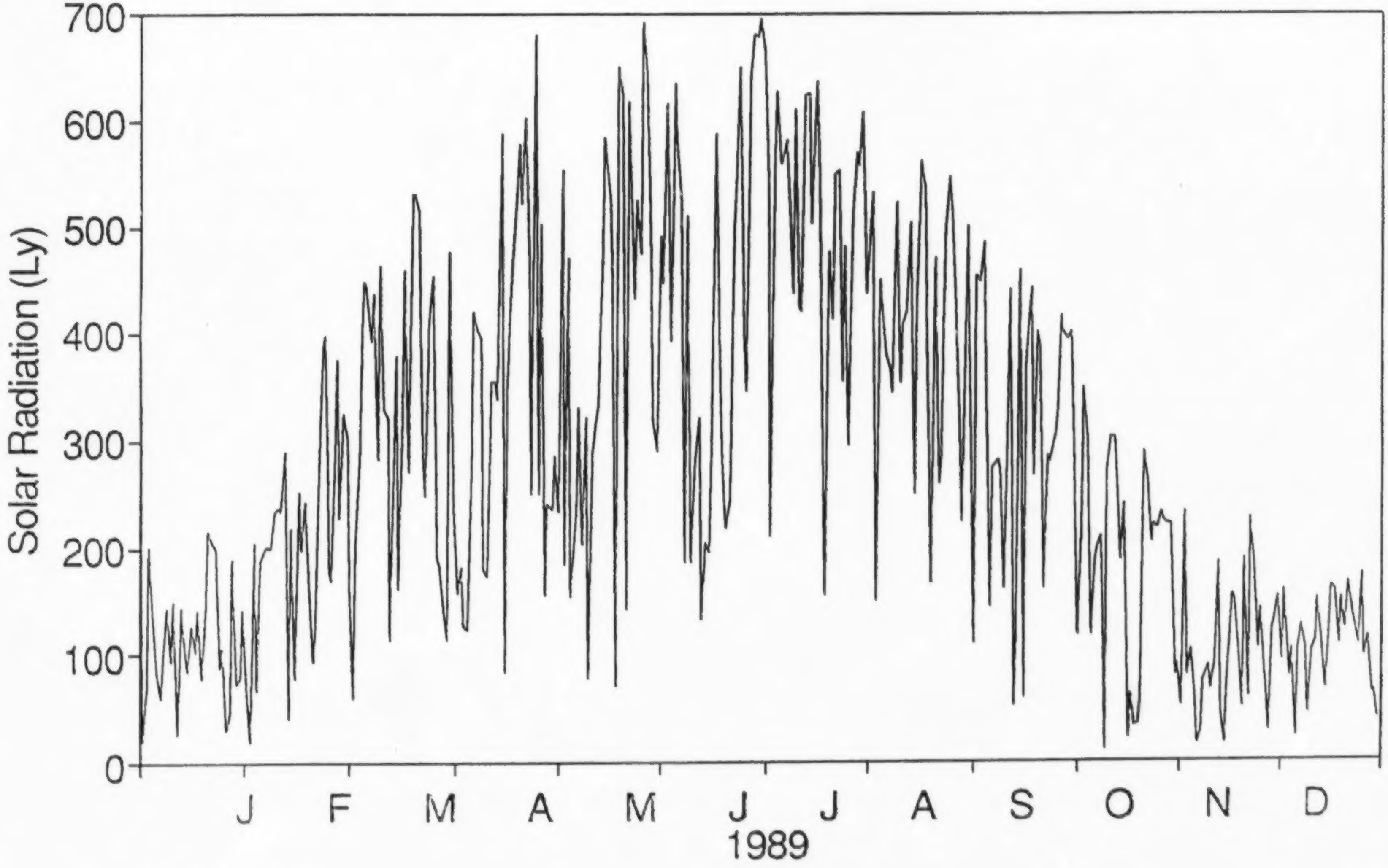


Pittock Watershed

Solar Radiation 1989



Pittock Watershed

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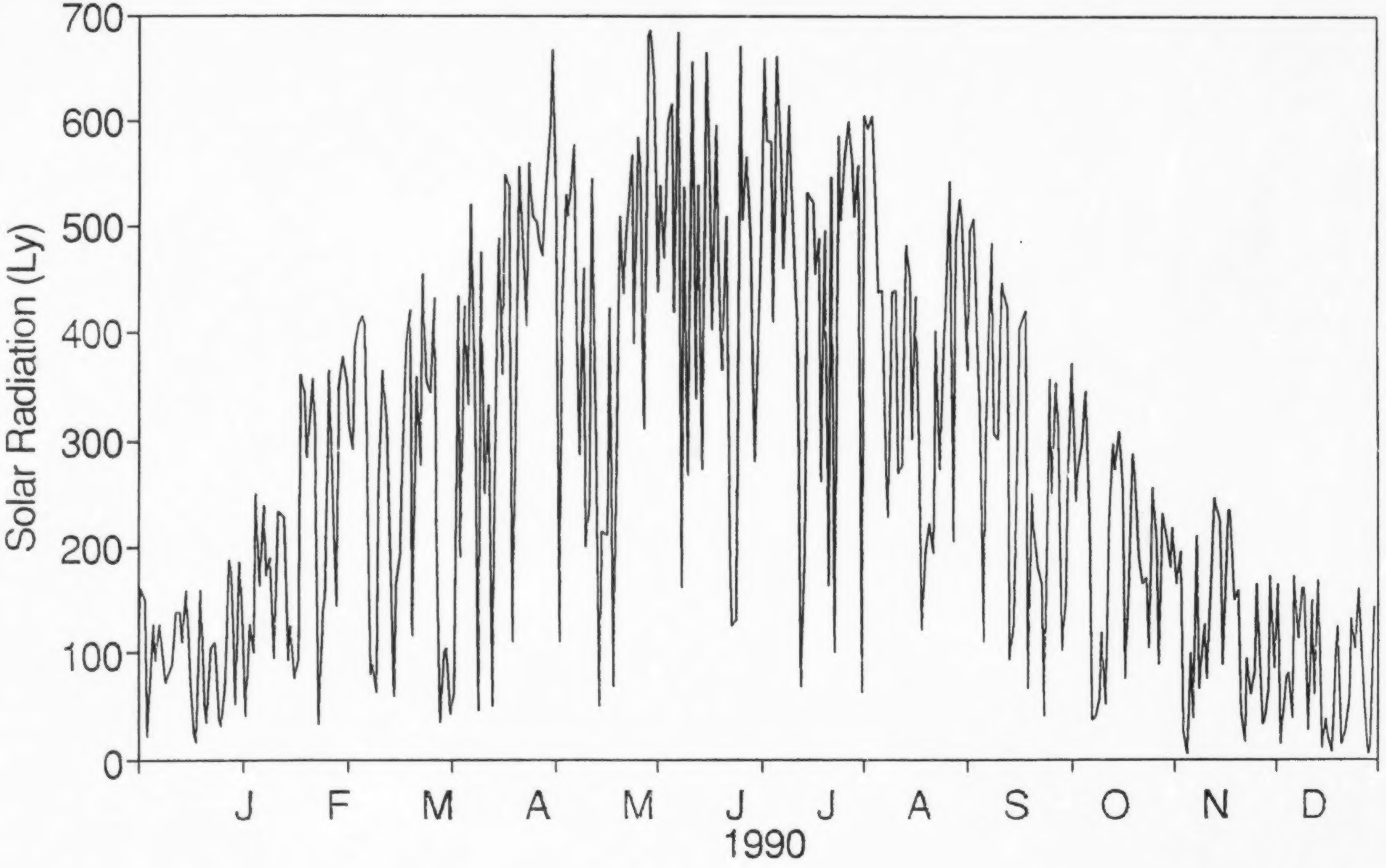

Pittock Watershed

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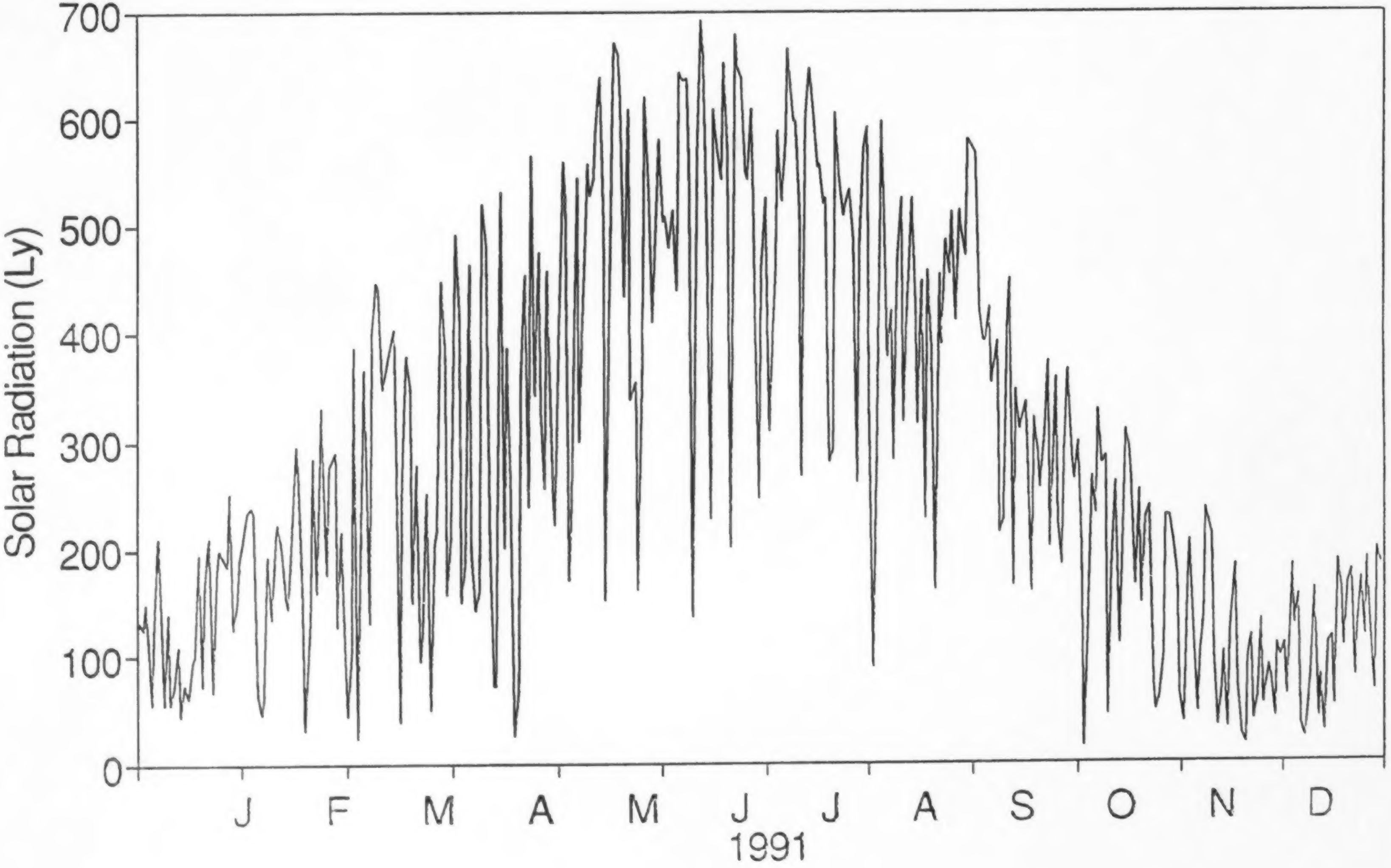

Pittock Watershed

Solar Radiation 1992